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ORIGINAL ARTICLES

THE GRAPHIC RECORDING OF REFLEXES, CLONUS AND TREMORS.

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In undertaking this work, two great problems were confronted—1st. The securing of consistent constant graphic records of the reflexes, clonus and tremors; 2nd. Their interpretation and the underlying physiological basis.

So many were the difficulties and so great the time consumed in attempting to solve the first problem that all questions of interpretation will be deferred for later communication.

Prominent among the early workers making accurate studies and contributions to our knowledge of nervous phenomena, is Marshall Hall¹, whose findings, demonstrating the reflex or excito-motor system of nerves, were published in 1838. Within the next decade he demonstrated that the posterior columns of the cord were sensory, while the anterior were motor in function.

Preceding and leading up to these important discoveries of Hall, were several investigations worthy of mention in this connection. J. H. Miller², of Baltimore, started his work in 1809 and demonstrated important functions in relation to the great sympathetic plexus of nerves and included information relating to this work in his lecture delivered at the Washington Medical College in 1827. Brachet³, carrying on researches in France, also made important contributions. Perhaps most important, however, are the brilliant discoveries of Sir Chas. Bell of

London⁴ demonstrating the distinct sensory and motor functions of the posterior and anterior roots of the spinal cord. His publication appeared in 1824. An earlier communication of Hall's presented to the Royal Medical Society of England in 1833 should also be mentioned.

Though the work of these men was conducted independently, they arrived at the same general conclusions and established definitely that the sympathetic plexus is connected with the posterior column of the cord and that the motor impulses pass from the anterior roots.

Three other important contributions should be mentioned before taking up the work of Westphal and Erb. George Morton⁵, of Philadelphia, published a research in nerve physiology in 1839, entitled "*Grania Americanae*." The work of Magendie Floures⁶ on the relation of the brain and medulla oblongata to the functions of the cord, and that of H. H. Smith,⁷ are to be mentioned in connection with the development of our knowledge of the various reflexes.

Since Westphal and Erb⁸ recognized the values and introduced studies on the knee jerk, or patellar tendon reflex, it has been a fruitful field for scientific research and extensive literature has been gathered about it. The work of Fuerbringer⁹ on section of the cord in the upper dorsal region of rabbits showed that lively knee jerks could be elicited despite the claim of Rosenthal and Mendelsohn¹⁰ that, after trans-section of the cord at different levels, the knee jerk is lost, and that the production of the reflexes required an intact arc in the region of the cervical enlargement.

In the work of Gad and Flatau¹¹ with high trans-section of the cord in dogs, weak knee jerks were obtained or were sometimes temporarily abolished, though with low trans-section of the cord the knee jerk continued.

A short time later Sherrington¹² conducted comprehensive and extended studies on the

knee jerk in monkeys, doing trans-section at various levels, and also observed carefully all the other reflexes affected. His report shows that knee jerks were lost for a time, though in cats and dogs that were transected at the same time, the reflexes were not lost even on trans-section as high as the cervical region. The resulting shock produces a temporary disturbance, which in man is of longer duration.

Following this Margulies¹³ demonstrated that cutting the cord produced lesions resulting in flaccid palsy, and crushing the cord produced lesions resulting in loss of the knee jerks.

Stewart P. Turner¹⁴ concludes that, though his findings were not constant on section in other animals, in monkeys the higher the level of trans-section the greater the likelihood of loss of the knee jerk, while in man transverse injury above the lumbar enlargement usually leads to loss of the knee jerk, though in complete transverse injury it abolishes it only temporarily. Trans-section produces an impaired neuro-muscular tone. Voluntary movement is abolished while the true reflex is not impaired. A great autonomy exists in the spinal segments in maintaining neuro-muscular tone as we descend the vertebrate scale.

The work of Buchanan¹⁵ done with frogs, particularly in electric stimulation and the timing of reflexes, to my mind shows only that the action of a carefully excised frog's muscle suspended in salt solution will differ greatly from that of the human muscle in normal or abnormal conditions. Waller¹⁶ did important work along the same lines, publishing his results in the early eighties. Lombard's work¹⁷ on the normal knee jerk is one of the most masterly studies made up to that time. In summing up his conclusions, he says—"It is highly probable that the tendon phenomenon is a direct muscular contact and the integrity of the nervous arc is necessary for its production."

Neuro-pathologists of the present day are following the teaching of Bastian that the cord is not the absolute center of reflexes: though there appears with most transverse lesions an increase in reflexes, the consensus of opinion is now that the tendon reflexes are independent of nervous action beyond the spinal cord.

Laborde (quoted by Jendrassik) reports instances showing that tendon reflexes persist after decapitation: hence brain action is not re-

quired for the production of all reflexes. Sahli¹⁸ believes that the cerebrum is essential. In contrast to the earlier ideas, Jendrassik¹⁹ has formulated a theory of reflexes which is based upon clinical evidence and is worth careful consideration. "Reflexes are spinal or cerebral or a combination of the two." Sahli, discussing the subdivisions of Jendrassik, says that "they do not consistently hold good" and he suggests that Jendrassik's group 3 be called cortico-nuclear, and those involving the spinal areas of innervation be called cerebrospinal reflexes, because in a transverse lesion of the cord the cerebellar reflex arc is also interrupted and one would expect a loss of cutaneous reflexes, but this does not occur since the lesion interrupts the sensory conduction through the cord and in a measure dams the sensory stimulation. (Jendrassik's group 3). To this group belong reflexes which have complicated centers, within which the reflex occurs, not as a single movement but as a series of such, e.g., sneezing, vomiting, swallowing, coughing, urinating, defecating, genital reflex (ejaculation). Therefore the peripheral impulse must find a path in the region of the lower cord segment. It generally selects the customary path (the formed spinal reflex arc) of the corresponding cerebrospinal reflex and so the cutaneous reflexes become purely spinal. This explains how many of the preserved reflexes retain their complete and identical distribution. It also explains how other reflexes, by means of the damming up of the exciting impulses at the lesion, attain both abnormal intensity and distribution by transmission of the impulse to the neighboring paths.

Sahli's theory contrasted with Jendrassik's simplifies the scheme of reflexes. There are two groups of reflexes: (1) spinal, or better, nuclear, because some of them occupy the region of the cranial nerves and would include the tendon, periosteal and joint reflexes: (2) the cerebrospinal or cerebro-nuclear reflexes, including both normal, cutaneous and mucous membrane reflexes and including also Jendrassik's group 3. In the latter group the brain and spinal cord act normally together: that is, the activity in the lower nuclear reflex arc is under physiologic conditions discharged by the cortex. In transverse lesions of the cord, reflexes of the second group may originate ex-

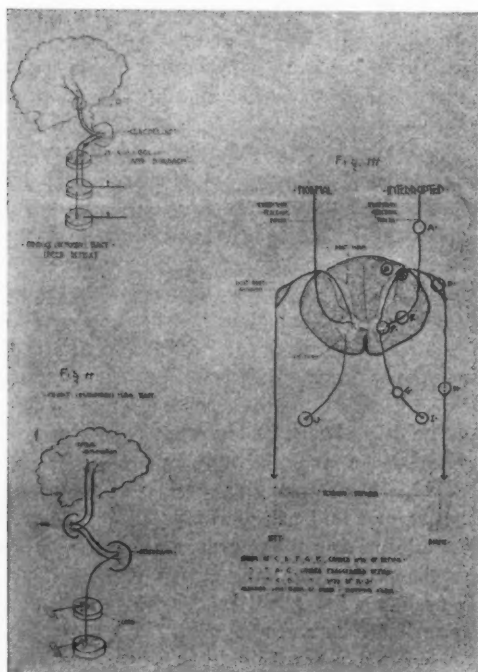


Fig. 1.—1¹. Indirect (sensory) Tract, (Deep Reflex.)
 1². Indirect (involuntary) Motor Tract.
 1³. Route of the Normal Reflex with Results of Lesions.

cortex through the indirect motor tract join the reflex arc, the governing action either is inhibited or accompanied by the impulse from the cortical area. (Fig. 12.) From the anterior horn cell the impulse passes along the motor nerve to the muscle.

Phelps²⁷, in a study at the Minnesota State Hospital for the Insane at Rochester, has carefully searched the literature of the knee jerk. He says, "Rather surprisingly there is no scale by which to measure the degree of this phenomenon." In his work he finds that in some persons the knee jerk was quick and short: in others, longer and slower. In one hundred normal subjects (attendants) there was one case of absent reflex. This case was observed over a year and also two normal individuals showing the opposite extreme—an ankle clonus. He estimates that in about two per cent of healthy people the knee jerk is absent, though Jendrassik's method of reinforcement succeeds in eliciting it.

Recently a strong reaction against the prevalent conception of muscular tonus has set

in²⁸. It is maintained that there is no such thing as a general contraction of muscle when at rest, but that a so-called tonus is the coordinative performance that calls forth a certain attitude by means of finely graduated contractions.

Many of the so-called pathologic reflexes should be regarded as deformations of the normal reflexes depending upon the encroachment on the reflex impulse of the pathways which become accessible to the impulse only because of an obstruction which is interposed in the ordinary reflex tract and in consequence of the reflex damming. The reflex, though modified, can still be recognized. In other cases reflexes occur as pathological phenomena, a peculiar exaggeration accompanied by reflex movements of a distinctly muscular type.

Sahl²⁹, in closing his chapter on a discussion of the segmental localization of the spinal cord, says—"The frequent contradictions which exist between the different writers show how unsettled the question remains; that accurate clinical and pathological examinations will not only supply numerous corrections but will extend our knowledge as well. These findings, especially where they concern the reflexes and their relation to the segments, must be critically examined for light on the genesis of reflexes."

Engaged in electrocardiographic studies during the years of 1914 and 1915 and noting in these records the deflections (extra-cardiac or extraneous) produced by voluntary muscle movement, the writer began a more systematic study of extraneous voluntary and involuntary movements. A normal muscular contraction produced a definite curve or series of curves while muscular contractions associated with some pathological conditions, as tremors, produced a definite type of oscillations of the galvanometer string. These oscillations passed through stages according to the degree of involvement, to a definite series of rhythmic oscillations as observed in clonus. Noting the constant recurrence of these records of muscular response, serious attempts were made to secure definite records of contraction of different groups of muscles. Securing constant results from these, attempts were made to secure records of various reflexes.

The results were so promising that early in the spring of 1916, with the assistance of Dr. Henry W. Woltmann, a systematic study of various reflexes and tremors was begun and graphic records were made with the string galvanometer, using the same instrument as that employed for studying action currents in the heart.

Our instrument is the Cambridge Modification of the Einthoven String Galvanometer, or electrocardiograph. (Fig. 2.)

Our earlier records were secured at the time of making the regular electrocardiographic runs, at the electrocardiographic station: with

Our attentions has been centered principally upon the study of the knee jerk and in recording this reflex. The apparatus as now employed consists of a chair (Fig. 3.) (1) with arms and back in order that the patient may sit in as comfortable a position as possible. The chair is elevated sufficiently so that the feet swing free from the floor. Attached to the front edge of the chair are two light boards (F) that are fastened to the back of the patient's leg. The upper end of each board is attached by a hinged joint to a rod (T) that runs along the front edge of the chair, permitting a lateral movement in order to adjust the leg

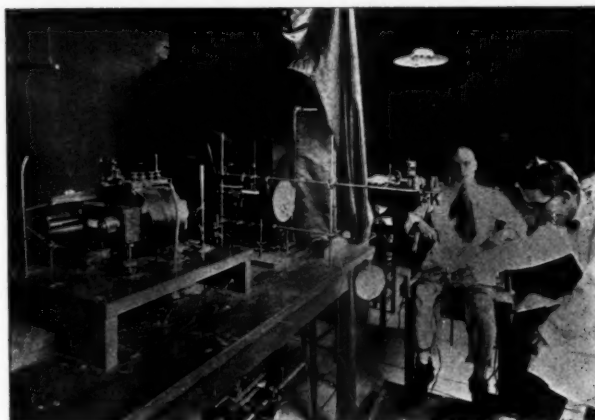


Fig. 2.—Apparatus in use at Millard Hall, University of Minnesota.

the recording apparatus in Millard Hall, University of Minnesota: the sending stations on the different floors of the University Hospital: the connection through under-ground cables some 1390 feet long. Communication with the operator was had by telephone wires passing through the cable.

In the fall of 1916 we returned to Millard Hall, taking records with the patients in the same room with the recording apparatus. The records obtained are identical in type with those from the hospital. The writer has made several new appliances, among them a device for recording the mechanical swing of the leg simultaneously and on the same moving photographic paper with the record of the electric action of the string galvanometer. Electric contact is made by recording the exact time of the blow, giving the signal on the margin of the paper.

boards comfortably to the legs of the patient. A vertical rod (E) passes through the centre of the front edge of the chair passing through a collar and is held in place by a set screw (V) so that it can be raised or lowered in adjusting the hammer position. The rod bends forward at right angles at the upper end and to this is attached a double set screw (S) which holds in position a rod (M) that passes at right angles to the forward end of the hammer support and is parallel to the front edge of the chair. This rod supports the hammer (C) in position so that with proper adjustment it will strike the knee in the same spot each time and give blows of the same intensity as many times as desired. The "electrical release" was tried, but catching the hammer on the rebound with the hand and elevating it to the desired position, then releasing, permits using a much simpler apparatus.

Several types of hammers have been used. Our earlier work was done with the ordinary percussion hammer, the blow being given with the hammer held in the hand of the observer. Later this was modified in order to record electrically the moment of the blow. A little later the writer devised the swinging hammer held in position by the support described above. A small metal-headed hammer was used, the metal

The hammer handle has five holes in it which permit it being hung upon the adjustable rod in such a manner as to allow adjustment for a blow of greater or lesser force.

The necessity of exact control in the strength of the blow early became apparent. This was accomplished in two ways. 1st. by varying the length of the arc through which the hammer fell, by suspending the hammer through differ-



Fig. 3.—The chair and its attachments, used in Obtain-Reflexes. Also apparatus (below) in obtaining Clonus Record.

head being placed in electric circuit, a small piece of metal gauze (D) being placed over the patellar tendon and being insulated so that no portion of it touched the body. This was placed in the circuit with a signal magnet placed at the lower or right edge of the slit of the recording apparatus of the electrocardiograph. Thus at the moment the hammer touched the knee the circuit was closed and a record made of the moment of contact. The loss of time that occurs by the use of this method amounts to approximately one fortieth of a second.

ent holes in the handle, 2nd, by allowing it to fall either 45 or 90 degrees. Figure 5a shows effect of dropping the hammer alternately through 45 and 90 degrees, and figure 5b, the same with re-enforcement.

The later model of hammer has a double contact head that does away with attachment of the metal gauze connections with the leg so that, when the blow is struck, a cap over the head of the hammer, but not in contact with it, is forced into contact, closes the circuit and produces the swing of the signal magnet indi-

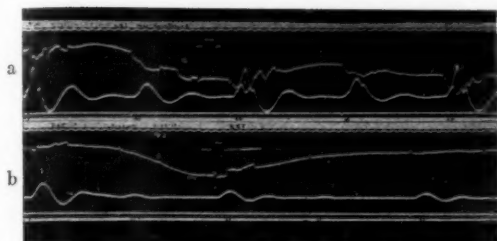


Fig. 5.—Shows effect of dropping the hammer alternately through 45 and 90 degrees.

cating the moment of the blow. The apparatus is arranged so that both legs are attached, double swing boards and electrodes being used. This permits the securing of repeated records of the same leg or of the opposite leg under the same conditions without disturbing the subject.

The electrocardiograph, such as we use in securing our cardiac records, consists of three units—a lamp, recording apparatus, and an Einthoven string galvanometer.

In securing records of knee jerks, the subject is seated in the chair described above, attachments are made to the galvanometer by means of electrodes (K and L) similar to those used in our electrocardiographic work, one electrode being placed upon the knee (L) and one placed on the chair (K) so that it comes in contact with the sacral region. The wires leading from either electrode pass directly to the string galvanometer though it is possible to carry them to any distance.*

The attachment to the string galvanometer are connected to Lead I and Lead II of the switch board and if a third record is desired, with attachment not only from the knee to the sacrum but to the spine, there is attached the Lead III which permits securing further records without disturbing the subject by simply throwing a switch as in cardiographing.

Various time markers have been used, giving records of one-tenth to one-hundredth of a second. The one-tenth second marker is the one usually employed by us and is of the Harvey type.

The apparatus for securing the mechanical swing consists of the swing board (F) in the inner edge of which are inserted three eyelets (O), to one of which is attached a hook

which is secured to an inelastic cord which runs over an adjustable frictionless pulley (H) to a hanging indicator suspended in front of the aperture in front of the lens of the electrocardiograph. The indicator produces a shadow parallel to that of the string galvanometer. Holding the indicator in position on the other side is a coiled steel spring (B in P Fig. 2), the tension of which is adjustable. So long as the indicator remains in a vertical position the tension on the string leading to the swing board is constant. This apparatus has given very constant and satisfactory results and produces a record that is of the highest value.

The record, as it appears, from a comparative point of view at the extreme left or upper side of the paper as ordinarily held, indicates the movement of the time marker: next comes the record of the galvanometer string: and then the record of the mechanical indicator: and at the extreme right or lower side of the record is the record of the time indicator.

One great difficulty that presented itself in securing records of reflexes was the adjustment of the string of the galvanometer so that records of a constant value could be secured. To overcome this the following method was used. When ready to secure a record, the subject being properly attached and the photographic record paper started, one millivolt of current was thrown into the circuit from the switch board, the string of the galvanometer having been adjusted previously so that as nearly as possible to secure a deflection of 10 mm. The introduction of this millivolt of current thus produces a deviation of the string so that the width of this primary deflection represents 1 millivolt (Fig. 4.) Thus we have a means of comparing the different records.

As a routine practice in recording knee jerks, we make three records of each limb, starting with the left: first the knee jerk, then the knee jerk doubly reinforced, and then a voluntary swing representing as nearly as possible the swing produced by the reflex. The greater care has to be used in securing the normal reflex to have the patient in as easy and comfortable a position as possible, with the eyes closed and the thoughts diverted from the reflex problem. Early in our work we found that the patient, being on the *qui vive*, and the operator of the galvanometer saying "Now" when ready, pro-

*At present we are taking records in the same room with the apparatus and also from the University Hospital, a distance of about 1,500 feet.

duced a reinforcement or increase of the reflex. Since then the operator signals by raising the hand when ready. In securing the reinforced knee jerk, a double reinforcement is used. The subject watches the hammer drop and, the moment it is released, pulls quickly. This reinforcement in most cases produces a marked increase in the electrical reflex Fig. 6 though in some subjects it has more of an inhibitory effect on the mechanical, the subject holding the muscles tense.

There is a marked increase in sluggish reflexes when reinforced by Jendrassik's method. In Fig. 7 this is well shown. While on the other hand reinforcement may have a tendency to decrease secondary and tertiary swings. This is well shown in Fig. 6, in which records 1 and 3 without reinforcement should be compared

In securing a record of the knee jerk, the patient is seated comfortably in the chair with sufficient clothing removed to easily get at the parts desired. The electrodes are placed in position with the same care as in cardiographing, being covered with a warm felt pad saturated with salt solution and this in turn covered with a piece of tissue paper. With the finger as a hammer, the point of greatest reflex action is located and this marked with a pencil. The leg swings are then secured to the leg and the cord to the mechanical indicator is attached and adjusted. The hammer is then placed in position and adjusted so that the point of greatest blow comes directly upon the spot previously marked. If a stronger blow is desired the hammer is moved to one of the holes higher in the handle. The indicator wire can be placed

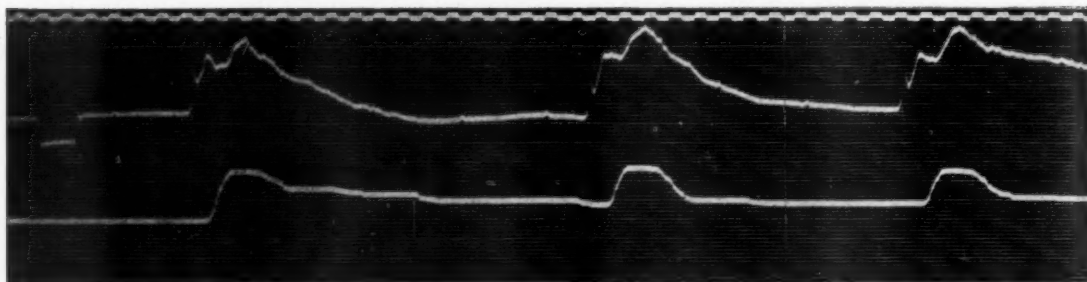


Fig. 4.—Three Knee Kicks, showing constancy of Record.

with 2 and 4 with reinforcement. In our earlier work, the records taken were "f s", full swing, "s r" swing and return, that is the leg was stopped after completing one outward swing and return to stop. These records do not show the secondary and tertiary swings. As in Fig. 8, though there was often a jar or rebound that was shown. Later records consisted of (a) the direct blow, (b) the blow reinforced, (c) the voluntary swing, resembling nearly as possible the movement caused by the reflex swing of the leg, with as complete relaxation as possible. The patient, having been instructed as to the voluntary swing, on signal kicks as nearly as possible in the same swing as produced by the reflex.

Three records are usually taken of each different phase for comparison. It is interesting to note in certain so-called normal cases that there may be a marked increase or diminution of the reflex evidenced with succeeding blows.

The arrow indicates the effect of introduction of 1 millivolt.

in position so that a blow of either 90° or 45° can be determined. This means that a blow of half or full strength can be determined without rearranging the apparatus. Fig. 5.

The difference of the knee jerk as observed by the eye and as recorded by our graphic methods is indeed marked. The knee jerk as ordinarily elicited may appear to be very similar, but by the graphic methods of recording may be extremely different. Cases, that by the ordinary method show no knee jerk, may, by the graphic method, show a marked electrical reaction with the string galvanometer. Fig. 7 The initial reflex action is evidenced by the rapid oscillation of the string resembling the sharp pointed R-wave of the cardiogram. This is usually of the diphasic type as the R-S wave, Fig. 6³, though in occasional records, as in neuritis, it may even appear as quadriphasic. This wave which we deem the true reflex action occurs in a very small fraction of a second after the blow is struck on the patellar tendon. Fol-

lowing this wave comes a wave or series of waves that are identical with the waves secured in the voluntary swing of the leg of equal length. Various factors, such as fatigue, drugs and toxic conditions in general, seem to influence the width of excursion of this reflex action, but the individual type of record remains constant and its relation to the inception of the oscillation due to the mechanical swing of the leg is the same.

Certain cases show a positive initial deflection indicated by movement toward the upper right side of the records and is usually of opposite polarity to the reflex itself.

The reflex is of very short duration, about one-fortieth of a second. At present we have

In the work of Lombard,³² Bowditch,³³ Warren³⁴ and Noyes³⁵ elaborate examinations were made of this feature of the knee jerk and extensive records were made from a subject by use of a delicately constructed apparatus.

Diller³⁶ examined the knee jerk of 103 students whom he considered normal. In no case was the phenomenon absent, though in one-fifth of the cases it was difficult to elicit, and repeated blows were necessary to bring it out. His conclusions were that the knee jerk varied greatly in length and rapidity of excursion. He says, "It would be desirable to measure definitely and record both of these elements".

Mitchell and Lewis³⁷, in summing up an extended research of the knee jerk, say—"In

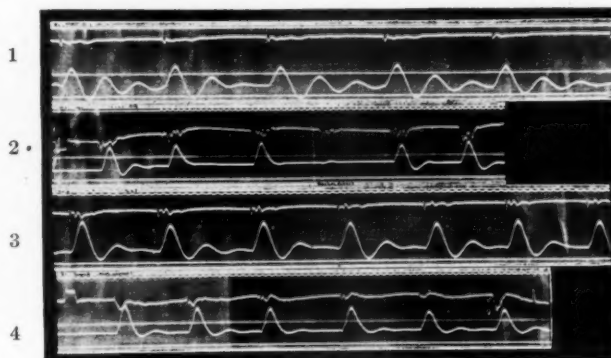


Fig. 6.—Tracings 1 and 3 show left and right K. K. Tracings 2 and 4 show same reinforced.

not the means at hand to accurately measure this, though later we hope to make a study of the various time elements. The mechanical swing of the leg usually begins one-tenth of a second after the reflex action and may consist of a single swing, or as many as five. The time element varies greatly in the swing in returning to the base line. If the subject holds the leg tense it is evidenced by a slower ascent and gradually receding descent of the marker to the base line, Fig. 4. This has been termed, by older writers, the "inhibitory effect."³⁰

The knee jerk varies in different individuals under different normal conditions. Though they are constant under similar circumstances, they may be greater early in the morning than later in the day (fatigue): increased after meals: increased by mental activity: increased by cold, voluntary movements, strong sensory sensation, or emotion. They are lost in sleep³¹.

some the same weight of blow causes pretty constant effect when steadily repeated at like intervals, but in others the effects are inconstant and a series of slight motions are apt to be followed by an excessively exaggerated act. Such persons make bad subjects for experimentation. This explosiveness is also apt to follow much excitation of the muscle. Even in the young and healthy the knee jerk varies markedly. It is more marked in the morning, in relaxing states of the weather, disability, exhaustion, all tending to lessen the ease of the reply to the tap."

The fatigue of a reflex is sometimes responsible for mistakes in diagnosis³⁸. The response to the first tap should be observed attentively because it may disappear after one or two repetitions. In testing periosteal and tendon reflexes it is especially important to use great care in eliciting reflexes, and to distract the at-

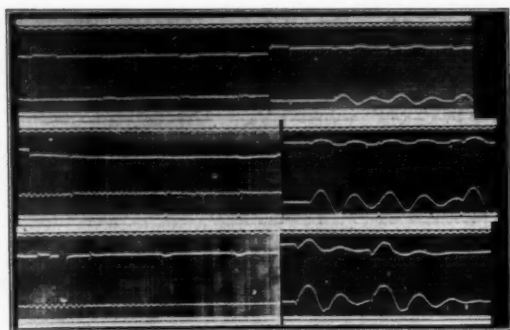


Fig. 7.—Reinforcement of Sluggish Reflexes. On left are group with small action. On right, same under reinforcement.

tention of the patient from the part to be examined, for through voluntary tension the reflex may be inhibited.

Individuals show a constancy in type of reflex that has continued through the period of our observations. The quickness with which the knee jerk responds and the muscular swing following are always of the same general type though they may be modified by various factors.

Knee jerks elicited early in the morning are much greater than those secured from the same individual later in the day or following extensive physical exercise. Fatigue exercises a remarkable influence on the strength and quickness of the reflex. I have taken records of runners under normal conditions and immediately following long cross-country runs. These records show decided lessening in all their forms. I have taken records, using the same individual, and secured records of repeated blows. Certain individuals show no marked change, though innumerable taps may be given, while others may show an increasing reflex and others a diminishing reflex with succeeding taps.

S. Weir Mitchell³⁰ says of Jendrassik's reinforcement that, "The discovery as to the power of the voluntary volitional muscular movement acts to increase the amount of the knee jerk". His conclusions are—"The knee jerk is a true reflex caused by mechanical irritation of the nerves of the tendon. Duly repeated excitation of the knee jerk in some healthy persons increase the knee jerk. Some cases show gradual loss to oft repeated taps and the muscle ceases to contract. Such movements as frown-

ing, moving the scalp or ears, moving the eyes, all act as reinforcements. Inspiration and expiration act as a decided reinforcement. Sneezing, laughing, acts of phonation, swallowing, and all of the coarser muscular acts increase the knee jerk. Pain, intense fear and cold also increase it."

Lombard⁴⁰, studying the knee jerk variations, demonstrated that fatigue, hunger, enervating weather and sleep were conditions which increased the activity of the whole nervous system, and, in consequence, the activity of the knee jerks.

It is a constant observation that the reflex action of the right leg is more marked than the left, as is also the accompanying muscular reaction. This is still more increased by reinforcement. Inflammatory conditions of muscle and nerve bring out a marked reflex increase together with an increased muscular response, though here the action is more irregular due to the irritation present. Former injuries and cases giving a history of neuritis show marked decrease even to absence of the knee jerk on the affected side. At all times great care must be used in securing the knee jerk, for, should the first response to the tap be small, the examiner might consider the knee jerk absent. He must observe each reflex quickly and accurately and make careful repeated examinations in order to determine definitely their presence or absence.

Sahli⁴¹ says—"Any psychic excitement considerably increases the tendon reflexes and this increase may serve as an important sign of the states of psychic excitement. The diminution of reflex sometimes observed in very acute, especially in traumatic, cord lesions is acceptable to the theory that this diminution is due to inhibi-

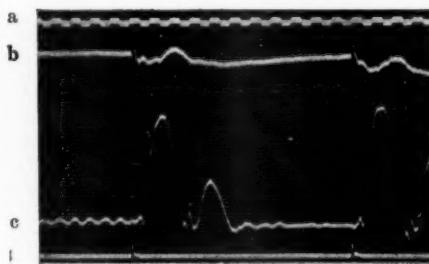


Fig. 8.—Knee Kick in Case of Multiple Sclerosis.
a) Time marker. b) Electrical response.
c) Mechanical response.

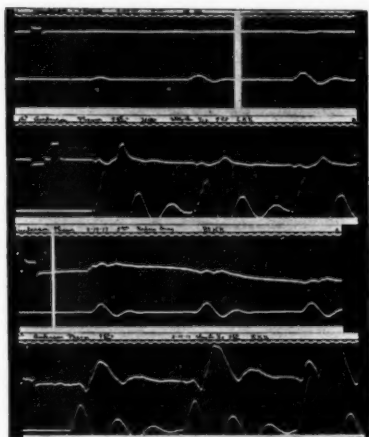


Fig. 9.—Tracings 1 and 3 show sluggish reflexes, 2 and 4 same, 45 minutes after gr. 1-10 strychnia.

tion or to injury to the lower cord segments from circulatory disturbances from the injury."

An injury to the cord produces a definite type of symptoms. The amount of trauma can only be determined by time, for a slight injury may show an absence of knee jerk for a few days followed by complete restoration of this reflex. In the more severe lesions a trauma may show complete loss of the knee jerk with no return, due to shock. These produce disturbances of the circulations which clear up within a few days. Any inflammatory condition of the nerves of the leg will cause an increase of the knee jerk. Sciatica, for example, produces a marked increase of the affected side that gradually becomes normal as the inflammatory conditions recede. A hemiplegia, due to hemorrhage, produces a broken arc in the upper arc, thus cutting off the inhibition factor and causing a greater knee jerk on the opposite side from the lesion.

As has been mentioned before, a few apparently normal cases show absence of the knee jerk (Westphal's sign)⁴² by the ordinary clinical method of eliciting it, yet, with our method of graphically recording reflexes, a minute electric reflex action Fig. 9¹, followed by an electro-muscular action is recorded.

Pathological conditions such as fatigue⁴³, anesthesia narcosis, tabes⁴⁴, Fig. 10. Entire absence of any leg swing is known in this condition. This failure is not mechanical. A large number of the tabetics have failed to show any

effects whatever of electrical change when the attempt is made to elicit the knee jerk. Fig 10. Three tracings taken at three different times, over a period of two months. On the left the reflex record and on the right the voluntary swing. Diabetes, paraplegia, poliomyelitis, and in acute infections for a short time, also the effects of certain drugs as opiates, may cause a diminution of the reflex action from a clinical standpoint, though, by our graphic method of recording, these cases will show a small reflex with a small electro-muscular and mechanical response. In students we made a careful study of the reflexes as effected by various drugs, among which were recorded, prior to and one-half hour subsequent to the administration of caffeine, grs. 5, and of strychnia sulphate, one-tenth gr. An increase following caffeine and an increase following strychnia, and with increasing response, each succeeding blow. The caffeine relieving apparent muscular irritation, while the strychnia increases the irritability. In transverse lesions of the cord⁴⁵, the cutting off of inhibition from the centers above markedly increases the reflexes. As a rule the knee jerk is permanently absent after total transverse lesions of the spinal cord above the level of the arc (Bastian's law), but the reason is not known.

Certain pathological cases present an increase of both reflexes and muscular action, such as myelitis, spastic paraplegia, multiple sclerosis⁶⁰ (Fig. 8) and lesions that cause a degeneration of the cord itself. Any irritable condition of the muscle, as in some of the toxic states whether from stimulant drugs as strychnia, (Fig. 9) or internal conditions, increase the knee jerk.

Many times we secure records of knee jerks that present peculiar formation in type, a char-

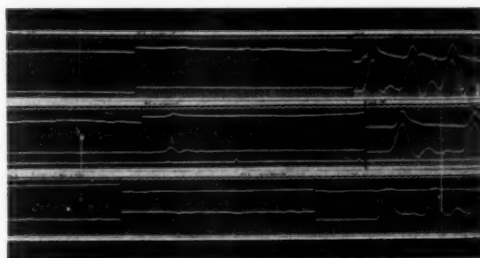


Fig. 10.—Tracings from Tabetic, over period 3 months.

acteristic form both in reflex and muscular response, apparently due to the predominant action of certain groups of muscle bundles in a definite manner. These individual types persist so that repeatedly we have obtained similar peculiar records from the same subject.

CLONUS.

Clonus may be defined as a reflex irregular contraction of muscles. In any muscle in an irritable stage with increased tonus, the tendency to clonus action is greater as the tone increases. The principal clonus described by clinicians are the ankle clonus, the patellar clonus and the jaw clonus. In securing ankle clonus, the knee is slightly flexed, the heel rest-

and fleeting, then one is dealing with spurious clonus, usually hysterical"⁴⁶. Clonic convulsions are rapid involuntary muscular movements repeated in shocks or series of shocks with force and rapidity. They are never occasioned by peripheral excitation of the motor nerves. There appears to be an accumulative irritability centre whose action may be compared to that of the Leyden jar, and seems to be essential to set off the shock-like explosions. Clonic contractions are practically always accentuated either by direct or reflex irritation of the motor centre whether it be the nuclear or psycho-motor centre of the cortex. Tonic convulsions, long continued, produce rapid contraction of the muscle which may suddenly

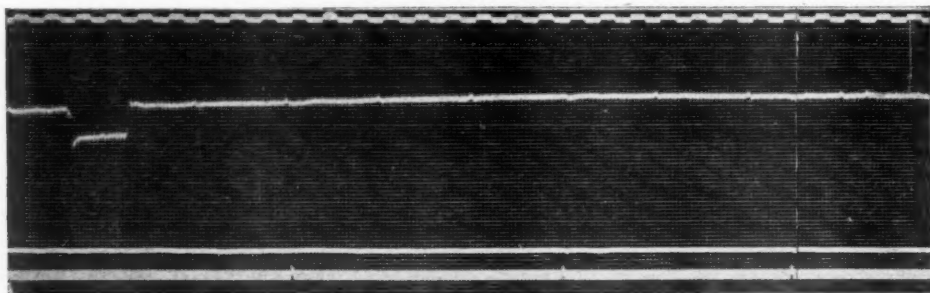


Fig. 11.—Tracing of Knee Kick in Tabes Dorsalis. Lower band shows three points, at which time blow was struck on knee.

ing on the palm of the examiner's left hand and his right hand grasping the foot, extending it and suddenly dorsi-flexing the foot upon the leg. An initial series of clonic involuntary contractions of the muscles of the calf is elicited and repeated under sustained pressure of the flexing hand. This constitutes true clonus. The patellar clonus is elicited, while the knee is flexed and the heel resting in the examiner's hand as before, by making quick and sudden pressure with the thumb and forefinger and suddenly pushing patella downward and holding it firmly. A clonus of the quadriceps extensor is thus produced. The jaw clonus is produced in a similar manner by suddenly throwing pressure upon the masseter muscles.

True clonus has the same significance as exaggerated knee jerk, and its relation to organic disease is most common in disseminated and lateral sclerosis. "If contractions appear before the degree of foot flexion exceeds a right angle and are evidently voluntary, irregular

change by implication and position or tension of muscle. It may be associated with or transformed to the clonic variety. A joint firmly fixed by the muscle contracted about it so that its movements are difficult or impossible is a condition called a contracture. The increased tension of the muscle may depend on increased tonus. The active contraction is an irritative reflex contraction while the passive contraction is a nutritive shortening of muscle. Active contractures may occur where muscle tone is increased since muscular tone is of reflex origin.

Bodwitch and Warren⁴⁷, in an article, say—"There is good evidence that clonus is a mechanical act the same as the knee jerk, hence should be similarly influenced by the peripheral nerve stimulation. Clonus may be reinforced or inhibited the same as a normal knee jerk of a healthy individual."

Ankle clonus presents a definite record by the graphic method that will materially assist

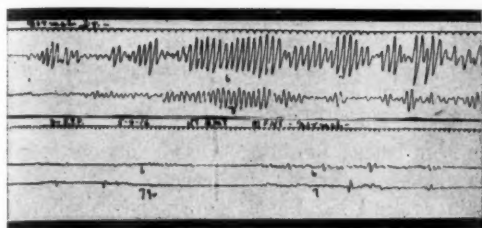


Fig. 12.—Records of Tremors, normal type.

in a better understanding of the work. To the unaided eye all clonus appears alike, but records show that there are three distinct types⁵⁰ due to fundamental genesis underlying as in a case of chronic lenticular degeneration, hematomyelia and primary sclerosis. A constant record may be obtained not only showing the rate and frequency of the clonus but also its strength as recorded by the width of oscillations and also the duration, whether maintained for some time or quickly dropping off, and the question of its fatigue is recorded in a permanent and definite manner Fig. 15.

The apparatus used in securing records of clonus is shown in Fig. 3. The arm band (Ss.) and pump of a blood pressure apparatus is fastened about the limb from which the record is desired. Tubing leads to the Marey tambour (R) which replaces the recording apparatus used in securing the mechanical swing of the knee jerk. Slight inflation is made with the pump. The electrodes are used as in securing the knee jerk and are attached to the string galvanometer.

TREMORS.

Among the earlier medical writers was Claudius Galen⁴⁸ who noted the fact that tremor existed and differed during voluntary movement and repose. Later Vieussens, in the latter part of the 14th century, was the first to point out the distinct and separate parts of the brain, and wrote extensively on the subject of tremors.

Haller⁴⁹, in 1708, in researches on irritability, established the existence of irritability as a property of living muscular tissue and that sensibility was due to the nerves alone.

Gilson⁵⁰, the successor of Harvey, in the middle of the 17th century brought out many new discoveries regarding nerve tissue. The doctrine of irritability, as taught by Haller, lead

to a greater physiological study of nervous tissue.

James Parkinson⁵¹, of London, in 1817 published his essay on shaking palsy and this is his greatest and most important contribution to Medicine. Parkinson's definition is—"Involuntary tremations, motion with lessened muscular power in parts not in action even when supported."

Tremors are rapid, minute muscular contractions with a rhythmic tendency. Tremor may appear in healthy individuals as well as in pathological states, hence the need of careful study and record. It may appear in normal individuals following physical exercises, mental agitation, cold, etc. Tremors are of two classes: (a) intention, or that occurring during purposeful movement, and (b) passive, or that tremor persisting during rest. Putting the individual muscle group in action or under continued strain increases tremor. All tremors of the extremities are increased by extension and may be wholly absent when the patient is at rest. Most tremors are a spastic phenomenon and the centres are located above the reflex arc.

Sahli⁵² believed that tremors are essentially manifestations of spasm just as every spasm is explained by the damming up of stimuli which causes an explosive instead of a constant discharge of stimuli from the ganglion cells. It is analogous to the spark discharge of an induction apparatus in contrast to the spray-like brush discharge following low resistance. To continue the analogy to explosive discharges further, we see that the succession of impulses underlying tremors may be based on the stronger stimulation of the motor ganglion cells on the one hand through the central neuron (paralysis agitans and nerve excitability), or through the reflex pathways (multiple sclerosis) on the other, because of the interruption of the motor current (peripheral palsies, fa-

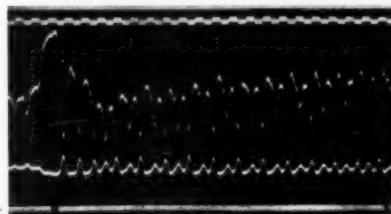


Fig. 15.—Record of Ankle Clonus.



Fig. 13.—Tremograph.

tigue, etc.) In all these cases there is the same disparity between the afferent and efferent nerve stimuli. This exposition is no mere hypothesis. It rests upon the well-known general recognized property of the ganglion cells to accumulate impulses and discharge them explosively though we have as yet no further explanation. It suggests a fundamental characteristic of nerve power which is a physiological observation. This brings us to a closer understanding of the different types of physiological tremor.

As has been stated previously, as a result of a careful study of the various irregularities that appeared upon our cardiograph records and finding that many of these finer movements were due to tremors, a more careful study of tremors was commenced, and soon the necessity was apparent of an apparatus that would graphically record the various movements of tremors. It was desired that this apparatus should be small and compact and capable of being used by the physician in general practice. Fig. 13. As a result of experiments, the writer presented the Tremograph,⁶⁰ Fig. 1 (L. S.), and demonstrated its use at the Minnesota State Medical Society in the fall of 1916. This apparatus is used in conjunction with the recording apparatus of the modified McKenzie Polygraph (B)⁵³, and gives a light, compact apparatus for making definite accurate records of tremors and clonus in a permanent form and with the time element portrayed, Fig. 14.

The Tremograph consists of two tambours (E) set at right angles, so placed that one is vertical and the other horizontal to the axis of movement. These tambours are connected with the tambours of the modified McKenzie polygraph by rubber tubing (G). The movement to be recorded is accentuated by the placing of spring vibrators of steel wire (H) in front of the tambours. Metal olives (F) with screw adjustment to permit their being placed

in different positions along the spring vibrators, increase the oscillations and give a marked record of the vibration. Various handles are used which permit the securing of different types of records. These can be screwed on to the apparatus and are used for securing records of different parts of the body. (A). Plain round handle (C) ordinarily used and held in either hand. (B). The tonometer (D) with screw socket placed on one end which permits the apparatus being used for securing pressure tremors. (C). The slightly curved plate 2"x3" with two straps and buckles that permit placing it immovably on any part. This is especially used for tremors and used principally on the lower extremities.

In order to secure analogous records of patients under similar conditions, the following procedure is adopted. The patient is made as comfortable as possible, whether seated erect in a chair or in bed. If in a chair, the feet should be flat on the floor and the hands on the knees. The handle of the Tremograph is then placed in one of the patient's hands and held between the thumb and extended forefingers, the horizontal arm to the front. The patient is then instructed as to the motion to be made with the instrument. The following movements have been used by us in securing records as being representative of all voluntary movements.

1. "R. T." (R and L) "Rest Tremor". This record is secured by having the patient raise

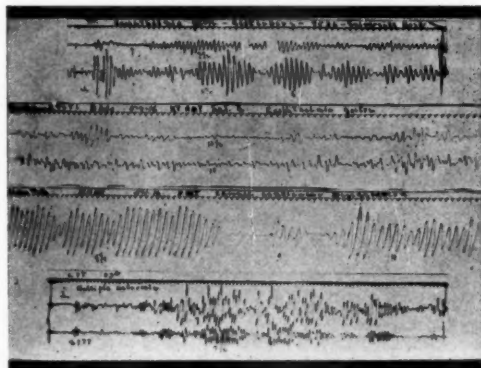


Fig. 14.—Records of Tremors:

- a. Exophthalmic Goitre.
- b. Exophthalmic Goitre.
- c. Chronic Lenticular Degeneration.
- d. Multiple Sclerosis.

the hand from the position on the knee, (a) front and upward to full extension of arm, (b) then holding arm at full extension, (c) then returning to knee position. These movements are made in a definite time—five seconds to each move or position, the rate of movement being indicated to the patient by the operator's arm. This is of advantage, as the attention of the patient is focused and any uneasiness relieved.

2. "P. T." (R and L). Pressure Tremor, same as Rest Tremor only tonometer is used as handle and held gently, arm raised (1) then at full extension, (2) the patient compresses handle to limit, then at (3) releases to gentle grip and return to knee. Record is made on slip of the grip pressure.

3. "F. N. T." (R and L) Finger Nose Test. The round handle (A) as used in (1) the movement consists of four positions, each occupying five seconds—as in (1), (a) knee to full extension, (b) then elbow is bent bringing the instrument, still vertical position, close to nose, then (c) back to full extension and (d) back to knee.

4. "R. T. Leg." (R and L). The metal pad (C) used and attached to top of foot. Each foot is brought up (a) to full extension, (b) held, then (c) returned to floor.

5. "F. K. T. of Leg." (R and L). Foot Knee Test. (C) attachment as in (4) movement (a) to full extension, (b) foot brought close to opposite knee, (c) back to extension and (d) back to floor.

This produces a series of tracings which cover practically all the common movements.

Tremors of the tongue may be tested by a little aluminum clip attached to one of the spring vibrators, and the tremograph attached to some solid object. The tongue is placed on the aluminum clip. For coarse tremors a smaller sized metal olive is used which produces a narrow oscillation of the writing lever.

In eliciting tremors by the older methods⁵⁴ "to distinguish between passive tremor and intention tremor, direct the patient to make some movement such as taking up and fastening a collar button, buttoning a vest, or drinking a glass of water. In this latter variety the tremor is greatly increased by the co-ordinate movement involved and indeed may be wholly absent when the patient is at rest. By

resting the tips of the patient's fingers (Quinquad's phenomenon) upon the palm of the hand, a vibration otherwise imperceptible may be readily detected." This is the usual form of noting tremors by clinical methods. Though this does not give a definite estimation of the rapidity or the strength of the tremor, still with a careful observation by this method the clinician was able to determine whether the tremor was fine or coarse.

Many types of apparatus have been used to estimate and record graphically the various forms of tremor but all of them were cumbersome and complicated for common use.

Warner⁵⁵, in the early eighties, brought out interesting but complicated apparatus consisting of an arrangement of rubber tubes, one for each finger, and each leading by the piece of tubing to an elaborate apparatus with a smoked drum, the frame supplied with recording tambours and electric signals. By means of this apparatus he brought out some interesting figures on the movements of the hand and its various parts.

Various other devices were used and much valuable data has been gathered by⁵⁶ Grashey, Schafer, Peterson, Horsley, Wolfenden, Ewald, Gowers and Dana. Peterson⁵⁷, in 1894, published very interesting results of exhaustive work on tremors. From these records A. E. Hennely of the Edison laboratory constructed a very interesting geometrical chart of the recorded waves. In his summary Peterson says—"Compared with the kymograph, the sphygmograph is coarse, crude and uncertain in the reproduction of various tremors. Most tremors can be placed in two categories—fine, from 10 to 12 per second: and coarse, from 7 to 8 per second, corresponding to the normal innervation rhythm as determined by Horsley and Schaefer⁵⁸. A slight tremor with normal innervation wavelets which are fused in groups of two gives the rate of 5 per second."

In a study of tremors by Neustaedter⁵⁹ in 1909, he brought out a new type of apparatus. By means of this apparatus a careful study of various types of tremors was made in some 600 cases of pathological type. His conclusions are as follows: "1. I want to say that the difference between different tremors are of kind, not of degree, and each form of tremor is distinctive of a

form or group of diseases. 2. No definite relation exists between one form of tremor and any other. 3. The frequency of movements has no bearing upon the character of the tracing. 4. There is no material difference between the movements of the two sides of the body."

CONCLUSIONS.

1. Graphic records of reflexes, clonus and tremors may be secured

- a. By means of the string galvanometer,
- b. By means of apparatus recording movements of the regions involved, i. e., mechanical action. Such records may be designated broadly as reflexograms.

2. Graphic records of reflexes may be secured showing the form of electrical and mechanical response and also time elapsing between—

- a. Stimulus and electrical response in muscle.
- b. Stimulus and mechanical response of parts.
- c. Electrical and mechanical responses.

3. In the normal reflexogram two elements are found:

- a. An initial deflection of short duration—probably a definite reflex response. This appears to be present only in the records of electrical response.

b. Definite responses due to muscular action. These show both in the records of electrical and mechanical response. These responses may be reinforced, e. g., by Jendrassik's method, or inhibited, e. g., by psychic factors, producing probably a state of tension or resistance in the muscles involved.

4. Tonus plays an important part in the reflex act. Modifications may be due to an abnormal state in the afferent or efferent segments of the reflex arc and to conditions above the reflex arc.

5. In the reflexograms from abnormal individuals, the records may show modification of the reflex response (diminution, exaggeration or perversion) due to altered conditions from fatigue, drugs and pathological conditions in the reflex arc and in the upper neurons.

6. These records are so consistent, definite and permanent as to have a medico-legal value.

7. Irritability may be increased, in varying degrees and when this is sufficient, clonus may

be produced. Clonus records show rate, amplitude, duration, response to increase of pressure by the manipulator, and fatigue.

8. Records of tremors show rate, rhythm and amplitude. Tremor occurs in normal individuals and in them is increased by voluntary movement. Tremor is modified in individuals, otherwise normal, by such factors as toxic states, fatigue and drugs. In abnormal individuals alterations in rate, rhythm, amplitude and effects of voluntary movement are recorded.

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STUDY X: THE ETIOLOGY AND TREATMENT OF ACUTE POLIOMYELITIS*

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The studies I have made on the elective localization of bacteria indicated that the methods used in studying the localizing power of the bacteria isolated by a number of observers in poliomyelitis, were not adequate to rule out their possible etiologic relationship. The results in herpes zoster were especially suggestive. Green producing streptococci, it will be recalled, were isolated from tonsils, pyorrheal pockets and sputum, and from the spinal fluid at the height of attacks of severe herpes zoster which, when injected intravenously into animals, produced herpes associated with lesions and localization of the streptococci in the posterior root ganglia. The infiltration in the posterior root ganglia in herpes zoster is similar to the infiltration of these ganglia in spontaneous experimental poliomyelitis.

Head and Campbell regard herpes zoster as an acute infectious disease which confers immunity, and suggest that it be designated as acute posterior poliomyelitis in contradistinction to acute anterior poliomyelitis. The possibility of a close relationship of the microbial cause in these diseases is further suggested by the observation of Romer who found that the serum of patients with herpes zoster neutralized the virus of poliomyelitis. Owing to these results a re-study of the bacteriology and the localizing power of bacteria of ordinary size obtainable from the throats and tonsils and from the nervous system in poliomyelitis, was undertaken. That the pleomorphic streptococcus found in such large numbers in throat and tonsil and in smaller numbers in the nervous system bears etiologic relationship to poliomyelitis is indicated by facts determined since my studies were begun two years ago as follows:

It is constantly present in the diseased tissues, from which it may be cultivated even many months after glycerolation. On injection

*Presented before the Minnesota State Medical Association August 29, 1918, Duluth.

tions of cultures into young rabbits and guineapigs it localizes specifically in the nervous system and produces flaccid paralysis and changes in brain and cord which resemble those in poliomyelitis in man. From the brain and cord of these animals the organism may be isolated and the disease again produced. The organism has been rendered filtrable. By means of the same methods the identical organism has been isolated constantly from the brain and cord of monkeys paralyzed with fresh, glycerolated and filtered virus. The serums of persons and of monkeys having recovered from poliomyelitis, agglutinate specifically the more sensitive strains both from human and monkey poliomyelitis. Injections of the recently isolated aerobic cultures into monkeys renders them refractory to virus. The aerobic form of the organism from human and monkey poliomyelitis produces antibodies in the serum of horses, in a large amount common to both, cross-agglutinating these strains specifically in high dilution. The serum of a horse immunized with freshly isolated strains from monkeys protected monkeys relatively against intracerebral inoculation of virus and had pronounced curative effects in the treatment of human poliomyelitis. Early intravenous injections were followed by almost immediate cessation of symptoms in a large series of cases.

The results of Flexner and Noguchi, so far as the cultivation of a small filtrable organism and its demonstration in the tissues in poliomyelitis are concerned, have been corroborated, but the results of our experiments indicate that this is the anaerobic and, according to Amcoss' results, a nonantigenic form of the organism which, under aerobic cultivation, clearly belongs to the streptococcus group of microorganisms. Both forms have been constantly demonstrated side by side in the tissues of poliomyelitis. Flaccid paralysis coming on soon after injection has been produced in monkeys with characteristic, although not typical changes in the cord with aerobic cultures, but the classic picture as obtained with virus in this species has not been secured.

It may be suggested, however, on the basis of results already obtained, that this is due to the development of antibodies, since the

organism in the aerobic form has marked antigenic powers.

The serum used in the treatment of cases heretofore was prepared by injecting freshly isolated strains from the brain and cord of monkeys that had succumbed to experimental poliomyelitis. During the past year, owing to the inability to procure monkeys on account of the war, the method of preparing the serum had to be modified and the strains for injection were isolated from glycerolated poliomyelitic material. Opportunity further to study this disease and to test the efficacy of the newly developed serum was afforded in the recent epidemic of poliomyelitis in Dubuque, Iowa. The results of animal experiments obtained in two previous epidemics were verified and extended. Conditions for studying the effects of the serum were ideal. The epidemic had begun two weeks previously. The number of cases were increasing and continued to increase for two weeks after the serum treatment was begun, and then gradually subsided. The symptoms and paralysis were marked. The mortality rate was high; eight of the seventeen patients who were reported as having the disease died and most of the others showed marked paralysis. Three patients died during the night immediately prior to the use of the serum. In four of the eleven patients treated with the serum on the first two days the prognosis was most unfavorable. The serum was administered to all patients irrespective of the stage of the disease. The diagnosis was established by spinal puncture. The mortality rate dropped from 47 per cent before to 4 per cent after the serum treatment had been instituted. Altogether fifty-four patients were treated. These may be considered in three groups: (1) those without paralysis; (2) those with slight paralysis, and (3) those with advanced paralysis at the time of the serum treatment.

There were twenty patients in the first group. All recovered without developing paralysis. There were fifteen patients in the second group. The paralysis was arrested in all but three in whom slight extension occurred. All have recovered completely or are showing rapid improvement. There were nineteen patients in the third group; two died. One was a poorly nourished weak baby two weeks

old, who showed no distinct paralysis but had refused nourishment during a period of seven days and gradually grew weaker and died seemingly of malnutrition. This is included as a case of poliomyelitis almost wholly on the spinal fluid findings. There were a positive globulin test and 40 cells per cm. One subcutaneous injection of 6 c.c. of serum was given with no apparent effect. The other death was in the case of a girl of 18 years, who had been severely ill for four days. A rapidly progressing paralysis of the ascending type began thirty-six hours previously. At the time of the first injection there was practically complete paralysis of both lower extremities, paralysis of the muscles of the back, of the bladder and rectum, of the left arm, a marked weakness of the muscles of the right arm, neck and muscles of deglutition, and marked shortness of breath with cyanosis owing to involvement of the muscles of respiration. The temperature was lowered and the paralysis was arrested for forty-eight hours. Eighteen hours after the third injection of serum respiratory embarrassment recurred and the patient died twelve hours later.

In the remaining seventeen patients the paralysis was arrested in those in which it was progressing. A distinct improvement in muscle function occurred soon after injection in those in whom the paralysis was stationary. Post-paralytic pains, if still present, were relieved, as long as ten days after onset in those in whom the spinal fluid still showed evidence of activity of the process. It is too soon to give the details of the final outcome in these cases. The preliminary results show, however, that the newly developed serum has distinct curative power in poliomyelitis. The results moreover indicate that the loss of muscle-function in the early part of the attack is due, in large part, to inhibition of physiologic function, and not to death of the ganglion cells in the anterior horns. The amount of good which followed the injection of serum was quite in proportion to the time of the injection following the onset of symptoms. Hence, in order to obtain the best results, the injection of serum should be given at the earliest possible moment, preferably before paralysis has begun, and before infil-

ration and edema in the anterior horns has become marked.

Dead ganglion cells can not regenerate and not too much should be expected from the injection of serum when their death has occurred. This disease has a quite characteristic syndrome which should lead to its tentative diagnosis and to immediate spinal puncture. However, there are some cases in which the premonitory symptoms are so slight as to escape notice; the paralysis sometimes is the first noticeable symptom. Hence the final solution of the problem of poliomyelitis must come from prevention, and from prophylactic immunization with a suitable antigen. Experiments along this line are now in progress.

Abortive attacks were numerous in this epidemic. Many children had symptoms resembling those of poliomyelitis which were too vague to lead to a positive diagnosis. A careful study of the state of health of others in the family in which typical cases occurred, and of the general health of the community at the time of the epidemic, the details of which will appear subsequently, brings with it the conviction that a large proportion of the population harbored this infection and that only one case out of the usual number (1 in 600 to 1 in 1,000 inhabitants) developed the typical syndrome recognized as poliomyelitis. From the studies I have made the infection appears to be due to a form of streptococcus (using this term in the broad sense) having peculiar localizing powers and specific immunologic reactions. In this connection it is of interest to note that the incidence of poliomyelitis in families and the community at large during epidemics in summer, is about that of rheumatic fever or pneumonia during the colder seasons when the more virulent streptococcal respiratory and tonsillar infections are prone to occur in epidemic form.

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POLIOMYELITIS: AN EPIDEMIOLOGICAL STUDY WITH SUMMARY OF AFTER-CARE TREATMENT IN MINNESOTA*

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Wickman, as early as 1907 formulated the theory that poliomyelitis was spread by contact from person to person, that non-paralyzed or abortive cases were very numerous and played an important part in the transmission, that healthy carriers existed and might disseminate the disease. He compared epidemics of poliomyelitis to forest fires which died out only after all available fuel had been consumed. Assuming Wickman's idea of the widespread character of poliomyelitis to be true, it must be the exception rather than the rule to have paralysis. If there are many mild cases it must be more contagious than heretofore regarded and the ever important well carrier must be considered as probable factor in transmission.

By studying the incidence of paralyzed cases only, the disease may be considered to be but

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slightly contagious. If, however, the disease in a mild form is very common and paralysis is the exception, then by improving our methods of diagnosis so as to include all non-paralyzed cases, carefully compiled field data would doubtless show marked contagiousness probable

Recent epidemiological and experimental studies strengthen our belief that Wickman's conception is correct.

During the past five years the writer has had opportunity to study a large proportion of the frank and suspected cases of poliomyelitis reported to the State Board of Health. The accompanying table gives number of reported cases for the past nine years.

Year	Cases	Deaths
1910.....	481	201
1911.....	115	58
1912.....	35	23
1913.....	85	30
1914.....	22	8
1915.....	123	26
1916.....	912	105
1917.....	75	10

In the epidemic of 1909-10 it is estimated there occurred at least 2,100 cases. During the five years following, an average of about 75 cases annually occurred.

In the epidemic of 1916, 912 cases have been recorded and studied. Seven hundred forty-one of the 912 cases showed paralysis with 105 deaths (14%). By including the 171 non-paralyzed cases, without deaths, the death rate is reduced to about 10%. Of the 741 paralyzed cases, 52 cases are assumed to be secondaries, there having been 3,339 persons exposed in the immediate families in this group.

In the whole group of 912 cases, 145 have been considered as probable secondaries while the number of persons intimately associated is only 3,675. This is an increase of two and one-half times the number of secondaries in the group of paralyzed cases. In this study only non-paralyzed cases which gave a history of exposure to a known paralyzed case have been included. Obviously, a great many non-paralyzed cases must have occurred which could not be included.

The writer will only attempt to give some impressions and observations from his studies together with a few isolated instances from the 1916 epidemic which appear to show that this

disease is transmitted quite directly from person to person. In collecting data on epidemic cases in outlying districts the best opportunity is offered for tracing associations. Every endeavor to prove that there are other modes of infection have failed. While the seasonal prevalence like that of typhoid fever, diarrhea, dysentery and other gastro-intestinal disorders might suggest insect transmission, all data studied gives little or no evidence along this line. Few cases, less than a dozen, showed bites of insects. Nothing could be found pointing toward dust as a possible factor. In all observations the incidence of cases bore no relation to sprinkled or dusty streets.

Evidence of the identical disease among the lower animals has been sought through the study of the central nervous system of domestic animals presenting paralysis or paresis of certain muscles or group of muscles. In some cases the examination followed death from the diseased condition of the animal, in others the animal was killed. Eighteen or twenty such examinations have been made, the autopsies, for the most part, being done in our own laboratories, the microscopic studies being done by different members of the staff of the Department of Pathology, University of Minnesota. No evidence of this disease occurring spontaneously in animals has been found.

Immunity seems to be an important factor in limiting the disease. One attack apparently protects for life. A second attack has never been noted although a number of incidences have been observed where the disease has entered the family a second time after intervals of years, picking out one or more non-immunes.

Several sections of the state were of especial interest epidemiologically during the 1916 epidemic. Winona, a city of 18,000, located in the southeastern part of the state on the Mississippi river, compares favorably with other sections of the state from a sanitary standpoint. A system of rigid inspection has placed Winona's standard for dairies on a very high plane.

At the beginning of the outbreak the physicians were thoroughly awake to the seriousness of the situation through recalling the epidemic of 1909-10. They called a meeting of the County Medical Society and passed

recommendations which were published in the local papers. Suspected cases were to be reported to the local health officer at once. Parents were advised to keep children at home. Children were forbidden to attend movies, Sunday schools, parties, picnics and all public gatherings except that public baths and playgrounds were kept open on the ground that open air association of well children would be safe. The public was greatly alarmed and many children were kept at home. No new cases developed for twenty days, then five or six cases occurred in children who frequented the public baths or play grounds. Upon visiting the baths it was found that children dressed and undressed in two large rooms which were overcrowded, there being ample opportunity for the exchange of nose and throat secretions.

In all 34 paralyzed and 2 non-paralyzed cases with 13 deaths (38%) were recorded. During July and August, at which time the height of the epidemic occurred, the physicians reported that at least 300 infants and children had gastro-intestinal disturbances which could not be diagnosed as non-paralyzed cases of poliomyelitis. Many, however, had muscular pains, hyperesthesia, ataxia, muscular weakness and trembling together with slight rigidity of neck, all of which are suggestive symptoms of poliomyelitis. It is unfortunate that an epidemiologist could not have been detailed to the intensive field study of this part of the state-wide epidemic. One cannot but speculate as to the probability of many unrecognized mild cases in this community and the apparent high death rate may be interpreted to suggest it. Here it seems probable that the epidemic abated as the individuals acquired immunity.

Millwood Tp., Stearns Co., is located five miles north of Freeport village. The population consists of well-to-do German-American farmers closely related by marriage and religion. Their school, postoffice, general store and creamery are grouped about the St. Rosa church. There is no record that poliomyelitis ever visited this section.

Two orphans were sent from an asylum in New York City to Minnesota for adoption, one to Minneapolis, the other to Millwood Tp. On arrival in Minneapolis one child, boy, G. S. was sick, having sore throat, nausea, vomiting and rigidity of the neck, but more

definite symptoms necessary to classify this as a case of poliomyelitis did not develop.

The orphan* girl F. W. (2) had no symptoms. On June 18, on the third night after going to Millwood Tp. she slept with a four year old boy, the only child of her foster parents. The boy developed symptoms June 28, was paralyzed June 30 and died July 1. A public funeral was held at the St. Rosa church several small boys acting as bearers. A large dinner closed the occasion.

Following the funeral within one week two cases developed in persons who attended the funeral. The remaining Millwood cases developed in persons who attended the funeral or who were exposed to cases.

The introduction of the disease into Melrose Tp. may be explained as follows: T. N. butter-maker, Millwood Tp., boarded in the home of a paralyzed case in which the first symptoms were on July 29. T. N. denied being sick at any time. On Aug. 13, he visited a home in Melrose Tp. where he and his two companions drank water out of a glass. Nine days later, Aug. 22, a seven year old boy in this family developed symptoms, was paralyzed on the 11th day and died after four months. Two other children had symptoms without paralysis.

The introduction into Todd Co. may be explained as follows: J. B. worked in Stearns Co., at the home of a child who was a non-paralyzed case, whose first symptoms were on July 4. J. B. is said to have been slightly ill for a few days but he himself denied having been sick. Frequent visits in Todd Co. made by him and his companion, a boot-legger, were followed by the development of a frank case of poliomyelitis in family visited. Other cases developed in exposed persons.

In all, there were 50 cases of poliomyelitis in Millwood and adjoining townships in Stearns and Todd counties as follows:

Millwood Tp., Stearns Co.—36 cases 8 paralyzed, 1 death.

Melrose Tp., Stearns Co.—6 cases, 3 paralyzed, 1 death.

Grey Eagle Tp., Todd Co.—6 cases, 3 paralyzed, no deaths.

Barnham Tp., Todd Co.—2 cases, both paralyzed, no deaths.

*On inquiry by Dr. H. M. Bracken, it was found that there had been no recognized case of poliomyelitis in the asylum although a severe epidemic was present in and around New York at the time.

The facts concerning the spread of the infection in this section appear to confirm the theory of the spread of poliomyelitis through contact with cases or well carriers.

In Deer Creek V., Ottertail Co., Mr. L's. two sons, William (7) and Paul, (13), had first symptoms on July 6. Mr. L's. daughter, aged 10, and her cousin, aged 8, who with her mother from Minneapolis, had been visiting in the family, beginning July 4, developed first symptoms July 13. Paul was but slightly ill and went to work July 8, on the farm of Mr. S. two miles north of Deer Creek. He worked two and one-half days though not feeling entirely well, then rested one-half day. He again went to work July 11, but was unable to work the whole day, and became a frank case. Two sons of the farmer where Paul worked developed symptoms on July 19 and 24 respectively. The latter died July 27. An autopsy by Dr. H. E. Robertson of the Department of Pathology and Bacteriology, University of Minnesota, confirmed diagnosis. The father of these two boys had a sore throat, complained of feeling tired and of having a thick tongue soon after the first boy was taken sick, while the mother had pain in right shoulder and arm July 21. All except the oldest son drank out of the common dipper at pump, and he alone escaped all symptoms of illness.

In a family that lived next door to the L. family, there were two frank cases with first symptoms on July 13 and 15, and paralysis in both on July 19. Another child fell ill, having headache on July 15. Poliomyelitis in these two families was not recognized until after the death in the farmer's family above mentioned.

In Chester Tp., Goodhue Co., Frances P. (7) had first symptoms Aug. 3 and was paralyzed Aug. 9. Henry L. (10) from Montana, who was visiting his grandmother, a neighbor of the P. family, stopped to play with other children of this family on Aug. 6. He had just bought candy at the nearby store and all partook of his candy. Four days later Henry L. had first symptoms, was paralyzed Aug. 13.

In Little Falls, Bert G. (4) had first symptoms July 16, was paralyzed July 19. Poliomyelitis prevailed in Minneapolis at this time and Mr. and Mrs. G. V., of Minneapolis had been visiting in the G. family from July 13 to 15.

Mr. and Mrs. Frank D. of East Grand Forks and their three children who had also been visiting in the G. family, left for home on July 14 and stopped in Osakis with friends until July 21. A child in this Osakis family became sick July 22 and was paralyzed July 24.

The above are only a few of the instances which might be cited from my field experience. They merely confirm other epidemiological and experimental data. The greatest care was exercised in making the diagnosis of poliomyelitis in all cases, 153 suspected cases seen during the 1916 epidemic being ruled out.

Before taking up the after-care of poliomyelitis cases, I wish to report to you, for its timely interest, the present status of this disease in our midst.

Throughout the state exclusive of Houston and Fillmore Counties there have been 14 cases in 1918, 7 occurring during the summer months, June, July, August. These cases have occurred in 13 sanitary districts in 12 counties.

Since June there has been a local epidemic in the southeastern section of Minnesota along the Iowa border. The center of this epidemic is in and around Spring Grove. This section of the state consists of a rolling country with a great many bluffs which extend toward the Mississippi River. A branch of the Milwaukee Railroad connects the villages in this part of the state and gives the inhabitants one train each way a day. Most of the travel is toward La Crosse. The farmers in this section are mostly Norwegians and are quite isolated from other parts of the state. The physicians state that poliomyelitis has not visited this section since 1907-08.

The earliest recognized case was in Preble Tp., Fillmore Co., first symptoms June 12. To date there have been 36 cases, 19 paralyzed, with 8 deaths. Thirty-one of these cases have occurred in 10 sanitary districts in Houston and Fillmore Counties, while two cases are just over the boundary line in Allamakee County, Iowa.

The epidemiological study has been omitted though some interesting data has already been collected.

After-Care Treatment

It is desired at this time to merely bring before you a brief summary of the after-care work of poliomyelitis cases as carried out by

the State Board of Health. This work was made possible by a special grant of the legislature at its last session.

The following table shows the number of poliomyelitis cases examined by the After-Care Clinic.

Classification of New Cases Examined

	Before 1916	1916	1917	Not Poliomyelitis
1st Series	462	470	9	110
2nd Series....	248	54	32	68
3rd Series....	224	39	10	62
	934	563	51	240

In the three series of clinics which have been held since June, 1917, at 22 different centers in the state, 1,548 persons suffering from the results of poliomyelitis have been examined and advised. In addition 240 persons were examined and informed that their trouble was due to some other cause than poliomyelitis.

The total number of persons examined at all clinics including old and new cases, 2,764.

Recommendations of Clinic

	1st Series	2nd Series	3rd Series
Exercises.....	320	311	444
Supports.....	376	60	114
Braces.....	47		
Operations...	148	71	34

Recommendations for operations have been made to the attending physician with the expectation that an orthopedist would be consulted. Brace cases for the most part have been treated the same way, only a few minor braces being supplied at the request of the physician in attendance. All indigent children are put in touch with the State Hospital for Crippled and Deformed Children. Other needy cases have been put in touch with some one of numerous hospitals in the twin cities and elsewhere which made very generous reductions of their rates to these patients.

At the present time 1,155 persons are under the direct supervision of the 8 district nurses who make frequent visits aiding in the carrying out of directions given by the clinic. Nearly three-fifths of old cases examined in the last series of clinics, May, June, July, were

reported as improved. A small number were advised that further treatment is unnecessary.

It should be kept in mind that the value of this work is due not to superior knowledge or ability of any set of workers over that possessed by others trained in orthopedic work, but rather to the carrying along with the advice to the too often discouraged parent or patient much encouragement and stimulating assistance through aiding in the carrying out of details.

The public press has given assistance through its interest in the work and its willingness to give notices of the clinics. The public, especially through certain clubs and certain social and business organizations, has shown great interest and contributed very materially in furnishing rooms, telephones, typewriters, etc., for the use of the mobile clinic.

The physicians throughout the State have very largely helped to make this after-care work undertaken by the State Board of Health, a success and their co-operation has been much appreciated by the members of the Division Staff.

"RICKETS"*

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In presenting this subject for consideration, I intend to dwell largely upon the clinical symptomatology. The large number of children who are brought to the physician because of symptoms arising entirely from the disease entity known as rickets, and the frequency with which this condition is overlooked, necessitate its repeated discussion. In a series of one hundred cases reviewed for this paper, the complaint of failure to walk at the usual age occurred twenty-two times. In the remainder of the cases in which the diagnosis of rickets was made, the complaint was due almost invariably to a symptom of that disease. Curiously, only one child was brought to us because of "head sweating," a very common manifestation. Too much emphasis can hardly be laid upon the necessity for early treatment and also upon the sad outlook for the neglected cases.

*Presented before the Annual Meeting of the Minnesota State Medical Association, Duluth, August 28-30, 1918.

The usual study of a disease demands that we look into the etiology. Theories concerning the cause of rickets are so numerous that I cannot take the time even to touch upon them. From clinical observation, it is possible to state that two factors are important. First, a latent predisposition due to specific heredity, the nature of which is still unknown; second, manifest intra and extra uterine injures to the growing organism. Among the former, we may include prematurity and twin pregnancy, and among the latter, improper food, bad housing conditions and improper care. Our series includes four twins and four premature infants.

The disease is encountered in infants as young as two months and as late as the fourth year. The acute cases in which the symptoms are macroscopically and microscopically recognizable are most common between the sixth and eighteenth months. Geographically, the disease is confined to the civilized countries of the temperate zones. Certain races are more prone and we all recognize the extreme deformities seen in the negro and in the offspring of the emigrant from southern Europe.

Pathologically the greatest changes, both microscopically and chemically, are found in the osseous system. The periosteum and bone marrow are hyperaemic and hyperplastic, resulting in spongy exudates which later may become calcified. The bones, as a result of insufficient calcification or entire absence of mineral deposits or even the absorption of salts already deposited, are soft and under stress of muscle action and body weight deformed.

The exhaustive chemical researches of Shabad and his pupils, long prominent in medical literature, have added much to our knowledge of the disease. His findings show that the bone of newborn infants contains 60-65% mineral ash. This decreases up to the second year, when it again begins to go up until it reaches the adult normal of about 80%. In severely rickitic bone, the ash may fall as low as 20%. Calcium and magnesium salts are most markedly reduced. Gassman has identified a complex calcium and phosphorous salt which is the same in diseased and healthy bone. The latter author finds that the potassium, sodium and chlorine are the same in

both, but magnesium is markedly decreased in the rachitic and concludes that magnesium plays a part in the pathology.

In the acute stages of the disease, the balance between intake and excretion is diminished or negative, later it may again become normal even though the disease remains active and progressive. The increased excretion takes place entirely through the intestines, the excretion through the urine being decreased. Stoeltzner maintains that experimental rickets produced by feeding animals food poor in calcium content is anatomically, chemically and clinically identical with spontaneous rickets. A series of blood examinations by Findlay shows that in active and uncomplicated rickets, anaemia is not the rule but to be regarded as due to external causes.

The clinical symptoms in the osseous system permit of a didactic division into four groups:

1. Symptoms of delayed bone formation.
2. Symptoms of bone disappearance.
3. Symptoms of bone softening.
4. Symptoms of excessive and abnormal bone formation.

In the first group are placed those cases which suffer from failure of longitudinal growth of the various parts of the osseous system. These may or may not show deformity. The affection of the vertebra causes shortening of the trunk. The delay of the growth of the jaws, aside from the resulting malposition of the teeth, gives the normal sized cranium the appearance of being too large. The failure of the development of the long bones results in various degrees of dwarfing. Furthermore, the acute stage may cause a complete cessation of longitudinal growth. Together with the abnormal muscular flaccidity and painful periosteal processes, this may cause marked delay in the acquirement of the static functions at the proper time so that the child does not creep, stand or walk as early as the well infant. They do not balance the head, cannot sit up and refuse to put the feet down when held upright. In the cranial bones, this delay of growth is seen in the persistence of the open fontanel, which may remain patent as late as the third

year. Dentition is always delayed in the rickitic infant. In the series in which seventy-five cases were over eight months old, severely retarded dentition was noted in twenty-eight. Enamel defects are very common.

In the second group, we have a very manifest symptom which is easily elicited and appears early; namely, cranio-tabes. This is the softening of areas of the occipital and the posterior portions of the parietal bones. When the hands are placed firmly around the head, the fingers dent the parchment-like occiput as though they were pressing an old stiff hat. The symptom may appear alone. It is found only during the first year. This condition was encountered thirty-two times in the series, in which there were fifty-six infants under a year of age. When combined with "head sweating," the excessive perspiration of the occiput, we are justified in making a diagnosis of rickets and instituting treatment.

The last two groups include the largest number of clinical manifestations and the grouping often becomes indistinct because of their frequent synchronous occurrence. As a symptom of bone softening, we have the appearance of Harrison's groove, the softened ribs being drawn in by the attachment of the diaphragm. The deformities of the long bones are due to muscular action, tonus and body weight. Severe Harrison's groove was noted fourteen times in the series and deformities of the lower extremities, such as knock-knee and bow-legs occurred thirty-four times. These bones are extremely liable to fracture and infraction, and such injuries may be mistaken for deformities. The rickitic deformities are, as a rule, pathological excesses of the physiological curves. The cranial bones may show various degrees of deformity giving us the large head, flattened in the occiput. The thorax, too, is often severely affected and, aside from the Harrison's groove, we may have chicken-breast, flared ribs or funnel breast. The lower extremities show the deformity to the greatest degree. The pelvis as well as the long bones may be the seat of the severest lesions. The obstetrician will bear me out when I call attention to the seriousness of neglected rickets in girls. In the long bones of the leg, we find such deformities as coxa vara, decurvation of the femur

forward and outward, curving of the tibia to resemble the sabre tibia of lues, genu valgus and genu varus and pes valgus.

The fourth group usually occurs synchronously with the third and makes the above symptoms more prominent. Again, in the cranium, eburnation of the frontal and parietal bones with huge bosses bring out the square or "cross-bun" head more prominently. Various degrees of this condition are noted fifty-four times in our series. The most important and most frequent symptom of this group is the thickening of the costo-chondral articulation, the well known "rickitic rosary." In the hundred cases under discussion, this symptom was noted eighty-four times, or in nearly all the cases. Autopsy shows that these enlargements are usually even more prominent on the inner surface than on the outer. The other common symptom of this group is the enlargement of the epiphyses of the long bones of the upper and lower extremities. It is most prominent and most easily recognized at the wrists and ankles. Epiphyseal enlargement was noted quite as frequently as the "rosary," occurring in eight-two cases. While the deformities may become so severe as to leave the patient almost grotesque, they are usually moderate and only rarely occur in groups of more than three or four. Those parts of the skeleton that grow most rapidly or are subject to the most continuous use are most severely affected.

Without giving the manifestations of the disease in the osseous system further consideration, we will go over the symptoms in other systems. Anaemia is nearly always present, although it may be due to the poor hygienic surroundings in which rickets commonly occurs. In the later stages of the disease, the general lymphatic system is affected and in children with rickitic deformities prominent lymph nodes and enlarged tonsils are common. Furthermore, there is always a definite myopathia manifesting itself in muscular flaccidity, shown clinically in the distended abdomen, umbilical hernia, the hyper-extensibility of the joints, kyphosis, etc. Distended and pendulous abdomen was noted twenty-eight times in our series and umbilical hernia, thirty-two times. Kyphosis was noted thirty-six times. In this general atony of the

musculature, the unstriped as well as the striated muscle takes part and, on the part of the intestinal tract, we very often find constipation, noted forty-one times in our series.

In the nervous system, the disease manifests itself by extreme irritability and peevishness. The child cries for no reason and acquires habit spasms, such as the nodding spasm or youngar patients twist the head to and fro on the pillow until they have worn off all the hair. During their sleep they perspire freely and chiefly on the occiput, so that the mother often complains that the pillow is wet with perspiration. This symptom was elicited by questioning in seventy-four of our cases

The course of the disease is usually chronic and self-limiting. In the milder forms, there may never be anything to call attention to the fact that the child suffered from this disease. The patient was slow in learning to walk and was a very ill natured child, or perhaps, the gait was a little peculiar at first. But the severe cases require orthopedic treatment for the correction of the deformities. Although rickets itself is never a direct cause of death its advanced forms may result in complications that readily produce that dire result. As a consequence of the improper ventilation of the lungs because of the muscular flaccidity and the softness of the thoracic walls, bronchitis and broncho-pneumonia are common sequelae. Numerous authors consider spasmophilia and such of its manifestations as laryngospasm, a complication of rickets, but the two diseases are so nearly alike in the chemical etiology that the relationship is probably closer. The disturbances of nutrition following prolonged constipation need hardly be mentioned.

With a distinct group of symptoms in a given case, the diagnosis of rickets is always rather simple. Border line cases, or cases complicating other conditions, offer greater difficulty. The differentiation from Mongolian Idiocy, Cretinism and infantile scurvy requires careful study in the milder cases of the latter diseases, and rickets may occur in patients with these conditions. The kyphosis of rickets is readily distinguished from the same deformity in Pott's disease, on account of the fact that the latter is fixed. From osteomalacia, rickets is differentiated only by

the time of occurrence. Syphilitic deformities of the long bones may be recognized by the Reontgenogram.

The question of prophylaxis is rather clouded. Twenty-eight cases in the series were breast fed for six months, or more. The rest received a large variety of artificial foods, among which some of the most highly advertised full substitutes for breast milk predominate. Not having a social service, we can give no figures on the social status and home surroundings of our patients. Sixty-four come from average American stock and probably from the average American home.

In the treatment of this disease, three important factors are noted. First, diet. The rational child's diet must be insisted upon. In the nursling, a whole milk mixture and in the older child, a well varied diet of fruits, cereal, vegetables and reduced amounts of protein.

Second; Sunlight and fresh air. The patient should spend as much time as possible out-of-doors and, if possible, in the sunlight. The acute, florid disease is much more frequently seen in the early spring than after the child has had a summer out-of-doors.

Third; The famous Kassowitz prescription phosphorus and cod liver oil. It seems fairly well established that the beneficial effect of this preparation lies in the oil, but most pediatricists seem satisfied to use the prescription as first given by Kassowitz. This must be continued for at least three months, and better results are obtained by longer perseverance.

LITERATURE

- Schabad—Arch. f. Kinderh, 1910.
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 Stoeltzner—Pathology and Therapy of Rickets, Berlin, 1904.
 Findlay—The Blood in Rickets, Lancet, London, 1909, 1, 1164.

DISCUSSION

DR. J. T. CHRISTISON, St. Paul: (Discussing the paper of Dr. Scherer):

Mr. Chairman, Ladies and Gentlemen: Rickets seems to be a perennial subject, and I believe that Dr. Scherer is to be thanked for again calling our attention to it.

I do not believe there is a day but what the average pediatrician has sent to him by some of his brother practitioners, a child suffering with ill defined symptoms, irritability, sweating about the head, peevishness, sleeplessness, rolling its head from side to side, one or all or a combination of these symptoms; and he sends it to the pediatrician for diagnosis.

It is my personal experience that I am speaking from just now; and I do not believe that you ought to do it. It is not a difficult matter if you will take the time to have the baby thoroughly undressed, absolutely stripped, and carefully examine it. By making this statement I do not mean to say that any of you are careless, but my own experience as a consultant has led me to the belief that when the average general practitioner goes to see a baby he pulls up its clothes and looks at it for a minute; he may or may not take its temperature; he writes a prescription and says, "Try that!"

I cannot by any possible stretch of my imagination think that is fair to the baby. I have seen that time and time again. And he has not the time to wait 20 minutes or half an hour while I make the examination which I deem necessary. I cannot examine a baby in ten minutes, and I do not think any other man can, or woman either, for that matter, and do it properly.

We are sometimes asked this question: Why is it that rickets appear in a more severe form in the Italian population. There are several reasons for that. If any of you have ever had anything to do with a really truly son of sunny Italy you will remember that he is apt to be wrapped up for all the world like an Egyptian mummy. The mother has a piece of muslin 6 or 8 inches wide and about as many feet in length, and after the child has its ordinary clothing placed upon it, this strip is put up on the front of the neck, carried down to the feet, and up the back, and then rolled around the body. You ask one of these mothers why does she do this, and she will tell you that it is because she wants her child to grow up straight. Now, that is the worst possible thing that she can do. The child does not get any exercise; and if there is one thing that a growing baby requires, it is room to kick its feet and wave its arms.

I believe another reason why we have rickets so frequently is because the babies are overclothed, and they are subjected to high temperatures. If I may digress for just a moment from the subject of rickets and say a word on the subject of high temperatures. If the heat evaporation is entirely stopped, as it often is in young babies, what is going to happen? The retained heat will soon run their temperature up so high that the physician becomes alarmed. It is not ten days ago that I was asked by one of our St. Paul physicians, to go to a first class hospital to see a child which he declared was suffering with pneumonia, because it had a temperature of 104 3-5. We put the baby out on the examining table and stripped it; the nurse took the temperature while I was there, and sure enough that was correct. A careful examination of the chest of that child revealed absolutely nothing abnormal. The child was left lying upon this table, without a stitch of any kind on, for just 30 minutes, and the temperature was again taken, when it was 101. The nurse's attention was called to this, and she was asked if she would be good enough to pick out this baby (pointing to one of a number that was in a row there, all covered up in the same way); and the result was that particular baby, which was only four days old, had a temperature of 103. The point I am trying to make is this: those babies have a bad

start. That sort of thing takes away from the child a vast amount of its vitality when it needs it the most. And I believe that these are some of the factors that later on enter into the production of rickets.

I do not think that we as medical practitioners are doing our whole duty when we do not insist upon the mothers doing away with the absurd and obsolete stuff that is used to cover up young babies. I say to them every day in my office, when I have the children there and undress them, and when we peel off garment after garment, usually ending with a woolen shirt, when the temperature out of doors is in the nineties, "How would you feel if you had a woolen garment like that next to your skin, and then cover that as you have this baby covered up? You would be fretful and peevish, too, and you would want a doctor."

I believe there are a lot of these little simple things that we are overlooking every day, and our children are not given the treatment that they deserve.

Whether rickets and spasmophilia and all these other allied conditions are one and the same thing or are manifestations of one and the same thing, I believe that if the children had the proper supervision and had proper care, and the proper guidance of a physician during the early period of their lives,—and I will put it a little stronger than that. If we could get the mothers before the children come, as we are doing in some of the cities in this country,—these conditions could be prevented. I would like to say right here that the city that we are now in is one of the pioneers in that particular line of work. The Duluth Baby Welfare Association is one that might very profitably be copied by any city in America. (Applause.) I want to say this, and I will not keep you but just a moment, that the Social Service side of the practice of medicine, insofar as prenatal work among the poorer classes of people is concerned, is going to do more to prevent these nutritional diseases and other preventable diseases than anything else that has happened to medicine in this century.

DR. E. D. BROWN, Minneapolis. (Discussing the paper of Dr. Scherer): In the therapeutics or treatment of rickets, I would like to ask if these men have read the articles reported by Schabad. He did an enormous amount of work, and as I recall it, he proved quite conclusively that calcium is not utilized when it was given as a therapeutic agent, especially in rachitis. He also tried phosphorous, and explains its beneficial action on the ground that it facilitated the utilization of the calcium. He employed combinations of cod liver oil and calcium, phosphorous and calcium, and cod liver oil alone. He found that the best results were obtained when either cod liver oil or calcium were given in combination with phosphorous. I did not know that Kassowitz was the originator of the prescription which bears his name, but I remember now that he pointed out that the mixture of phosphorous and cod liver oil seemed to be the most effective treatment.

DR. F. J. HIRSCHBOECK, Buhl. (Discussing the paper of Dr. Scherer): About a month ago there was an article in the Journal of the American Medical Association;

probably Dr. Christison and Dr. Scherer will remember it. I have forgotten by whom it was written, but in this article the treatment with phosphorous in rickets and allied conditions, was considered experimentally, and it was established according to his opinion, and rather conclusively to mine, that the phosphorous was instrumental in permitting the deposition of calcium salts in the epiphyses. The article is rather hazy in my mind, but probably Dr. Christison and Dr. Scherer have read it any may remember it more accurately than I do.

DR. J. D. BUDD, Duluth. (Discussing the paper of Dr. Scherer): I am very much pleased with the remarks of the last gentleman in giving Duluth credit for certain work which we are doing. I have the honor of being the physician for the Infant Welfare work in the city of Duluth, appointed by the Scottish Rite Masonic Fraternity, which has been carrying on this work for the last ten years. I am holding from four to five clinics a week. I have never yet had a baby come in that I did not strip to the skin—and examine carefully. In one case of rickets I saw the rosary. It happened that in taking off the clothes of the child I noticed the rachitic rosary; and upon investigation I found a case of rickets.

I have found a great many cases of rickets this summer. I never thought there was so much rickets in the world. The fact of the case is, there are lots of cases that would have been passed unsuspected if I had not stripped these children and examined them carefully. In the last week I examined 24 babies at one afternoon's clinic.

I had one case of rickets at the hospital, where the abdomen was so enormously distended and enlarged, that I eventually, with Dr. Schroeder, working in conjunction, drew off 37½ ounces of fluid. I have seen many cases of enlarged abdomen, but that was the only abdomen in which I have found ascites, especially to the extent that I found in that case. The baby was seven months old, and only lived a short time, and doctor Schroeder remarked that he had never seen a case of rickets that had such an enormous abdomen as this one had. Evidently there was some other cause besides rickets for the ascites.

I have had a great many cases, as I remarked. Dr. Kerley in his "Treatment of the Diseases of Children," recognizes the value of inunctions. He recommends goose oil or lard without salt, after a salt bath. I have been using that to some extent. I was sorry that the doctor did not mention inunctions, and I hope he will, in closing, state whether or not inunctions of oil are of value or if he prefers this Kassowitz treatment of phosphorous and cod liver oil internally? I was very glad to hear this paper on this subject this afternoon, because it is of very vital interest to me as the physician in charge of the Infant Welfare work in this city, where I am seeing so many cases of rickets.

Of course, these cases of rickets are in a portion of the city devoted to the laboring and poorer class of people, and many of the children have been brought up by bottle feeding, and especially on Borden's Eagle Brand Condensed Milk.

I would like to ask the question, if a child has to be brought up on condensed milk, if it is not better to use Eagle's Evaporated instead of the Condensed milk, which contains much less sugar. Those are two points on which I would like to have information; because I am still treating so many cases that I would like to have all the information possible for the benefit of the poor children of the city.

DR. H. W. HILL. (Discussing the paper of Dr. Scherer): I would like to ask about the relation of the vitamins. I did not hear them mentioned in the paper, and I wondered what the essayist thought about it.

DR. C. A. SCHERER, (Closing the discussion): I am indeed glad that this subject has called forth so free a discussion. The importance of thorough examination has been very completely covered by Dr. Christison.

In our office we concentrated upon the three points in the treatment as already mentioned, i. e., diet, sunlight and fresh air, and the Kassowitz prescription. The difficulty in giving this rather nasty mixture is largely a matter of the state of mind of the mother. If she is determined, the child will take it and soon get to like it. As for the various modifications such as the use of tricalcium phosphate in the U. S. P. emulsion rather facilitate the administration.

The inunctions of the oil mentioned by Dr. Budd have never been used by us. The mixture smells up the house even when put into the baby.

As to the vitamins, I have purposely avoided this question as it seems still rather hazy. It has recently been submitted that the Kassowitz prescription is beneficial because of the large amount of vitamins in the Cod liver oil. There is little doubt that aside from the deficiency of the calcium metabolism the vitamins play a prominent part in the etiology of the disease.

AUTOMATIC SYRINGE

A. N. BESSESEN, M. D.
Minneapolis, Minn.

This syringe was devised some years ago for use in local anaesthesia. It is not as satisfactory for that purpose as the improved syringe the construction of which was pub-

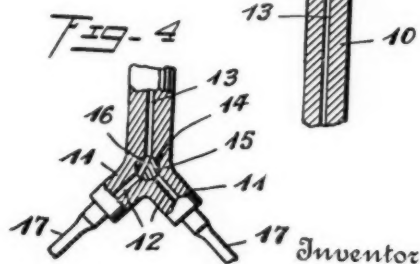
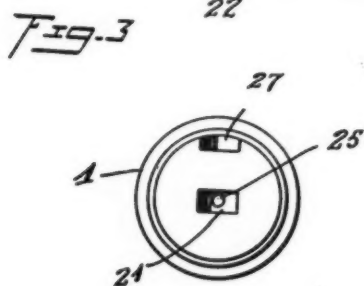
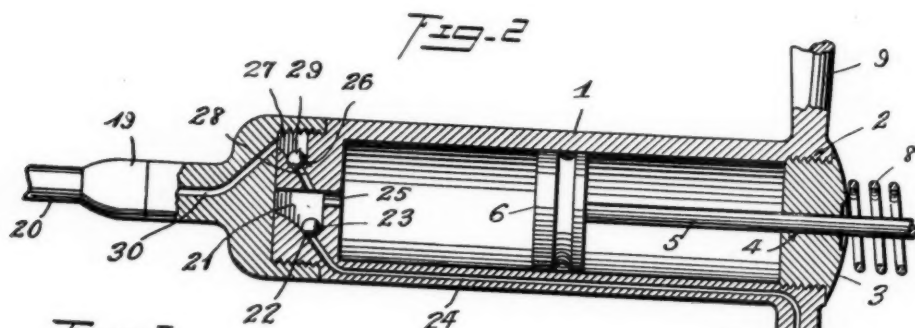
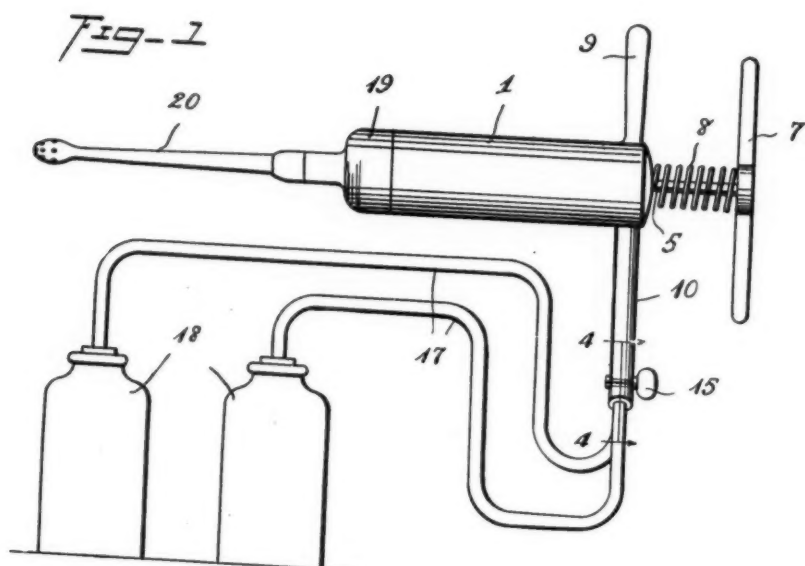
lished in the Journal of the American Medical Association, April 20, 1918, page 1145. However, this syringe is of a simpler design and the features of it can be applied to any ordinary syringe by constructing the part containing the valves into a separate piece, an adapter, so to speak, that can be interposed between the syringe and the needle.

In this original plan ball valves were used, but later experiments proved the pin type or drop valve to be the more satisfactory. Dr. Louis Dunn, of Minneapolis, has modified this syringe by eliminating the valve at the needle outlet. He depends on the tissues acting as a valve to prevent return of the fluid into the syringe. Naturally the instrument could only be operated successfully with the needle so imbedded. Dr. Dunn has used a syringe as above modified for some time and he claims to find it entirely satisfactory. It may be a question if this change is really desirable, certainly a syringe so constructed would require constant care in its operation to prevent the injection of air into the tissues.

The automatic syringe here illustrated will prove more satisfactory for washing out cavities; where a more or less constant flow is desired of a large quantity of solution, especially if it is necessary to inject the stream with some degree of force. And a small stream would require pressure to be at all satisfactory.

In irrigating the ear, urethra or cavities, or when used in connection with the cystoscope to distend the bladder it is not necessary to have the special containers illustrated; a rubber tubing leading to the syringe can be simply immersed in a basin or other vessel containing the solution, and the parts irrigated for as long a time as may be desired by the simple operation of the syringe.

BESSESEN—AUTOMATIC SYRINGE



Inventor
Alfred N. Bessen.

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EDITORIAL

THE MODERN PHYSICIAN'S ACTIVITIES

It is quite possible that one of the results of the war has been a broadening of the field of activities for the medical man.

In the recent emergency the profession was called upon to carry on a vital part of the war program. When we stop to consider what the nation would have done without the service of the thirty-five thousand physicians in active service and the thousands more not in uniform on the various examining boards we may be excused as a profession for some pride at the way we showed our patriotism.

Upon the medical profession depended the choice of recruits, the prevention of disease, the care of the diseased and wounded and the apportionment of just disability remuneration.

The morale of the private at the front depended as much on the near presence of the doctor as on any other single factor.

In short the profession was an absolute necessity in the execution and winning of the war.

It is to our everlasting credit that it was not necessary to have our services drafted.

It has always been considered that the physician owes a peculiar duty to the state in peace as well as in war. He has an education much better and broader than that of most other professions which entitles him to be looked to for his opinion and aid in situations which are often vital. His opinion, so important to the army, is coming to be more correctly appreciated when applied to civic questions. This means an increase in the demand for medical men of the bigger type, with a horizon extending much beyond his own narrow professional specialization. It means the opportunity for increased service to his fellow men oftentimes the greater because so likely to be unappreciated.

Are we going to allow jealousies or the fear of breaking some minor professional convention hold us back when an opportunity presents itself to do some real service to our community?

The physician too who does commendable work in his public activities naturally does well in his private work. This is as it should be and this fact should not deter him from such a field.

We have doctor-mayors, doctor-aldermen, doctor-governors, doctor-congressmen, and doctor-senators. Who knows but what the next president may be a doctor-president?

AMERICAN WOMEN'S HOSPITALS

The war is over. And yet there is still an enormous demand from various localities for help in combating the after results of the war. A most urgent plea comes from Serbia to assist in fighting the devastation caused by diseases in epidemic form. The American Women's Hospitals are now operating four in France and one at Monaster, Serbia. Mobile hospitals will be sent to Serbia as soon as sufficient funds can be raised. Send as large a donation as you can to Dr. Auten Pine, State Chairman, American Women's Hospitals, 749 Lowry Bldg., St. Paul, Minn.

SOME VITAL STATISTICS

The recent report of the Census Bureau at Washington gives some interesting statistical facts. The birth registration area in 1917 comprised fifty-three per cent of the country's population. If the birth and death rates

remain the same as they were in 1915-16 and 17 and no migration of population occurs, the population will increase at the rate of about one per cent each year or somewhat more than ten per cent in ten years which is about half the rate of increase—twenty-one per cent—of the entire population of the country between 1900 and 1910.

While the birth rates of white and colored population was slightly greater in the latter, the death rate was almost twice as great in the colored element.

The infant mortality showed in 1917 one death in every eleven, an improvement over the preceeding two years when it was one in every ten. It is interesting to note that Minnesota with an infant mortality rate of 67.4 per 1,000 was the lowest and Maryland with 119.9, the highest. When a comparison of rates is made on the basis of nationality of mothers it is again interesting to find that those born in Denmark, Norway and Sweden show the lowest rate, 66.2. As the infant mortality composes a large per cent of the entire mortality, the large Scandinavian population in Minnesota apparently is one factor which accounts for the low mortality rate in our state.

ADEQUATE MEDICAL SERVICE

In these days of progress in preventive medicine there is some tendency to separate too sharply preventive from curative medicine. It should not be forgotten that an adequate medical service to the whole people will do more to prevent disease and disability than any other single measure to be considered. At present the people in the United States are paying out money sufficient for the maintenance of an adequate medical service, but fail to receive it. This money, however, is spent in such a haphazard manner that the service is not only often inadequate or worthless, but at times actually harmful. For one item—drugs—the United States spends \$500,000,000 a year. This sum alone, if properly expended, would buy all the necessary drugs and add \$2,000 a year to the income of each of the 125,000 physicians in active practice in the United States.—B. S. Warren, M.D., Public Health Reports.

REPORTS AND ANNOUNCEMENTS OF SOCIETIES

MINNESOTA STATE HOSPITAL ASSOCIATION

The second annual convention of the Minnesota Hospital Association opened Wednesday morning, June 4, at the Hotel Radisson, Minneapolis, with an attendance of more than 100 hospital superintendent's and physicians from all parts of the state.

Registration of the delegates occupied the first hour from 9 until 10 A. M., after which the invocation was given by Rev. Henry Hartig, superintendent of St. Andrew's Hospital.

Mayor J. E. Myers of Minneapolis in a short address welcomed the delegates to the city. "We are proud," he said, "to have such a representative group of the state's physicians and surgeons gathered together in our city for the purpose of exchanging ideas in regard to more efficient hospital service."

An address by the president, Ernest E. Mariette, M. D., superintendent of Glen Lake Sanatorium, Hopkins, followed.

Co-operation of surgeons in charge of the base hospital at Fort Snelling was praised by Captain W. S. Miller in a talk on "Educational Service in United States Army Hospitals."

"The hospital at Snelling is easily one of the best in the country," said Captain Miller, who is an officer in the Sanitary Corps, U. S. A., at the Fort. "There is such a splendid co-operation of the officers in charge. It is indeed beyond the average.

"The standard of morale among the patients, who are mostly overseas men, was exceedingly low when I first came to the Snelling post," Captain Miller continued. "Military offenses were being committed with no respect for the law whatever. However, after securing close co-operation of the surgeons with the various departments matters have been so changed that the moral of the men cannot now be surpassed."

Rehabilitation was discussed by Harry W. Jones, Divisional Director of Rehabilitation Work in the United States Army. Miss Beatrice Lindberg, Industrial Worker for the Advisory Commission, gave a talk on "Industrial Work in Tuberculosis Sanatoria and its Relation to the Convalescent in the General Hospital."

Dr. S. Marx White of the University Hospital, Minneapolis, who recently returned from overseas where he served as a major with the University of Minnesota Base Hospital, No. 26, and G. W. Olson, superintendent of the Swedish Hospital, Minneapolis, discussed "The Relation Between the Staff and the Hospital."

The necessity of hospital medical records was explained by Dr. Horatio B. Sweetser of the staff of St. Mary's Hospital, Minneapolis, and Dr. L. D. Baldwin, superintendent of the University hospital. Dr. F. S. Bissell of the University Hospital told of "The X-ray in the private hospital."

"The Properly Organized Clinical Laboratory for the Private Hospital," was discussed by Dr. C. R. Drake, Pathologist, Swedish Hospital, Minneapolis.

Dr. John G. Bowman spoke on the standardization of hospitals and Rev. C. B. Moulinier, S. J., President of the Catholic Hospital Association and connected with the Marquette School of Medicine, Milwaukee, Wis., led a general discussion on hospital workings and hospital efficiency.

Opening at 8 o'clock with a talk by Dr. Johnson, president of Dawson Hospital, Dawson, Minn., on, "The Responsibility of the Hospital in the Smaller City to the Community," the evening session was given over for the most part to a Round Table Conference. This conference was conducted by J. E. Haugen of the St. Paul Hospital, St. Paul, Minn.

Four big questions relating to all hospitals in general were up for discussion. They were: (1) How can the superintendent safeguard the hospital against admitting patients who do not make the necessary financial arrangements in advance? (2) The management of dining-room service and who are to be served in the room? (3) Open hospital or staff? (4) What is the best system of keeping a record of condemned goods? (5) How can the need for nurses and student nurses be met?

The second and concluding day of the conference began with a talk at 9 A. M. by Miss Marian Tibbetts of the Social Service department, University Hospital, on "The Social Service Work in the General Hospital."

"One of the most important needs of hospitals today are proper dental, clinical staffs," said Dr. E. S. Kremer of the University hospital staff, in addressing the conference. "Up to the present and probably at the present time the mouth of a patient has not had sufficient medical attention. But it has now been found that the majority of hospital cases are also dental cases—the care of the mouth and the importance of the care of the mouth should be emphasized in every hospital."

A. L. Roberts of Rochester, Minn., told the delegates that he thought hospitals ought to be managed on a hotel basis. An address on the engineering problems of the present day hospital was given by Dean John R. Allen of the College of Engineering, University of Minnesota. "Hospital Finance—The Responsibility of the Community Toward the Hospital" was the subject of a general discussion.

Thursday's afternoon session was opened by G. W. Olson, superintendent of the Swedish hospital, Minneapolis, who reported on the legislation secured at the last session of the legislature.

Miss Carrie Epply, R. N., superintendent of nurses at the Minneapolis City Hospital, told of educating young women in the hospitals to make them efficient nurses and to fit them for hospital and home nursing positions. General discussions on questions relating to nurses and nursing were led by Miss Margaert A. Cowl, R. N., president of the State Board of Examiners of Nurses, and Miss Marian L. Vannier, R. N., acting superintendent of nurses of the University Hospital.

Enforcing an eight-hour law for women employees in the hospitals was urged by Miss Eliza Evans, secretary of the Minimum Wage Commission, as the means of preserving the vitality of the workers and making for more efficient service during work hours.

The final session of the convention was held Thursday evening at 7:30 o'clock. L. F. Foley, Inspector of the Board of Control, State Capitol, St. Paul, Minn., told of the physical aspect of the hospital from the point of the State Hospital Inspector.

The two-day convention closed with election of officers: Col. L. B. Baldwin, superintendent of the University Hospital, was elected president of the association for the coming year. Dr. P. M. Hall, superintendent of the Walker Sanatorium, was named first vice-president; Mrs. Sarah G. Knight, superintendent of Ashbury Hospital, second vice-president; Miss Naomi Johnson, superintendent of the Red Wing Hospital, third vice-president, and J. E. Haugen, superintendent of St. Paul Hospital, secretary-treasurer.

Members of the executive committee chosen include: Dr. A. B. Ancker of the St. Paul City and County Hospital; Miss Bertha Matlick, superintendent of Hillcrest Hospital, and Dr. A. T. Laird, superintendent of Nopeming Sanatorium, Nopeming, Minn.

Governor J. A. A. Burnquist of Minnesota; Dr. E. P. Lyon, dean of the College of Medicine, University of Minnesota, and members of the State Board of Control, were elected honorary members of the association.

The retiring officers with the exception of the second vice-president who was re-elected included: president, Dr. E. S. Mariette, superintendent of Glen Lake Sanatorium, Hopkins, Minn.; first vice-president, E. F. Paulson, manager of Norwegian-Lutheran Deaconess Hospital, Minneapolis; second vice-president, Mrs. Sarah H. Knight, superintendent of Ashbury Hospital, Minneapolis, and secretary-treasurer, Miss Lydia H. Keller, R. N., Minnesota State Board of Examiners of Nurses.

The executive committee included the president, ex-officio; the secretary, ex-officio; Miss A. Jeanette Christiansen, R. N., superintendent of Northwestern Hospital, Minneapolis; Dr. A. T. Laird; Miss Louise M. Powell, superintendent of nurses University Hospital and G. W. Olson, superintendent of the Swedish Hospital, Minneapolis.

MINNESOTA ACADEMY OF MEDICINE

The regular monthly meeting of the Academy for May was held in these rooms on the 21st instead of on the 14th. Postponement from the second to the third Wednesday was necessary to accommodate our visiting essayist. Ninety members and visitors sat down to table, the largest number ever to attend a meeting of the Academy. The serving of dinner was slightly delayed beyond the usual hour.

Following the banquet, tables were removed, a motion picture apparatus adjusted, and the meeting called to order.

Dr. Christison presided.

Because of the delay in getting started, the minutes of the preceding meeting was dispensed with.

The committee appointed several months ago, to report on the death of Dr. Williams, submitted a short sketch of his life, it was accepted and ordered spread on the minutes. The following is a copy of the report:

DR. CORNELIUS WILLIAMS

Born in Kentucky in 1848 Dr. Williams received a common school education, and took his degree in medicine from the New York College of Physicians and Surgeons in 1874. After post graduate and hospital work he began the practice of medicine in New York City, and worked as student and assistant in Knapp's Ophthalmic Institute his practice to diseases of the eye and ear, and soon became recognized as an expert in those branches of medicine. Well trained for the work at the start, he developed ability as a diagnostician judgment as a surgeon, and skill as an operator. His early operations upon the mastoid were notable for their thoroughness at a time when much of that work was done superficially. He used altogether the dental engine and burrs in cleaning out the cells, and always maintained the superiority of those tools over the mallet and chisel. Besides this Academy he was a member of the American Medical and State Medical Associations and of the Chicago Ophthalmological and Otological Society. He was president of the Ramsey County Medical Society in 1901, and of the State Medical Association in 1908. He died Dec. 29, 1918 at the age of seventy years.

Wm. Davis,
J. L. Rothrock,
J. W. Chamberlin.

The committee appointed in March to consider names for nomination from the state at large, presented a list of ten; also a supplemental list of five. The report was referred to the Executive Committee.

Dr. Abbott reported a case of postrectal tumor (calcified fibroma) in a woman fifty-nine years of age. She had never been pregnant. There was no relevant family history. Four years ago she began to have bearing-down and pushing pains about the rectum when on her feet or riding, and distinctly worse upon moving the bowels or in passing her water. There was some extension of pain to the thighs, but no backache. Slight relief on lying down. Conditions grew so bad that she declared another month would see her insane if something was not done to give relief. Physical examination showed all organs to be normal except a partial fixation of the uterus. Through the vagina a hard nodular mass could be felt behind the cervix, slightly movable, and very tender. In size it was about as large as a duck's egg. The rectum was movable over the tumor when palpated within that cavity. Beginning at the outer edge of the anus an incision was made as high up as the tip of the coccyx, having in mind the possible necessity of doing a modified Kraska. This incision was extended through the raphe of the levator ani muscle and the rectal wall dissected free with the finger. A capsule could be made out, which was opened with scissors and the tumor coaxed forward until it could be grasped with forceps. Enucleation through the opening made in the levator ani muscle was easy. There was no hemorrhage; the rectal wall was uninjured. In gross appearance the tumor is that of a calcified fibromyoma. Microscopically it is made up of fine fibrils, wavy, and with small nuclei. Non-

staining areas indicate the position of minute calcification. The arrangement of the fibrils lead to the belief that the tumor originally was a myoma. Such tumors are seldom seen, those springing from the surface of the bone being much rarer than those originating in the rectal wall. Text-books in general refer to them only as being possible. Tuttle reports three; Berg, Senn, and Westermarck report one each. Harrison Cripps mentions a similar case to Dr. Abbott's and McCoch on 1893, reported one identically like it. In dealing with it McCoch made a preliminary colostomy, and then did a modified Kraska, removing with the tumor a part of the gut wall as well. If another case falls into his hands Dr. Abbott says he will close the incision completely and not pack with gauze, as he did in this instance, feeling sure that recovery would be more rapid and less uncomfortable.

Dr. Staples reported the history and exhibited a patient suffering from polycythemia—meaning, literally, many-celled blood. A male 26 years old within the last year had developed muscular weakness, inability to work, headache and general lassitude. The various nervous symptoms which frequently accompany this malady have not yet appeared. His blood examination shows red cells 8,000,000 to 10,000,000; leucocytes 8,000 to 9,000; hemoglobin 135 to 150. Countenance presents a marked cyanosis; skin purplish red; veins distended and dark red. Clubbed fingers especially marked and characteristic. Spleen slightly enlarged. Treatment, unsatisfactory. Bleeding was beneficial in one of his cases.

Dr. Farr gave a demonstration by means of motion pictures that illustrated his method of using novocain. A number of operations were shown performed under its influence.

The paper of the evening was presented by Dr. W. J. Mayo on Splenic Anemia. Drs. Cross, Roberts, MacLaren and Robertson participated in the discussion which followed, Dr. Mayo closing.

F. E. LEAVITT, Secretary.

SIoux VALLEY MEDICAL ASSOCIATION

The Summer Meeting of the Sioux Valley Medical Association will be held at Sioux Falls, Wednesday and Thursday, July 16th and 17th.

Owing to the recent untimely death of the Secretary, Dr. Browning, it is impossible to give the details of the program at this time, but the programs will be issued in ample time.

The forenoon of the first day will be occupied with clinics. The scientific and business session will follow in the afternoon and morning of the second day.

Headquarters and sessions will be held at the Cataract Hotel, where the banquet will be served the evening of the first day.

A number of excellent papers will be read by men from the four adjoining states of Minnesota, Iowa, Nebraska and South Dakota and a large attendance is anticipated. A most cordial invitation is extended to the profession generally.

J. G. PARSONS, M. D., President.

OBITUARY

DR. ANDREW JOHNSON

Dr. Andrew Johnson died at St. Luke's Hospital, Duluth, June 3d. Dr. Johnson was born at Bergen, Norway, and located at Cloquet twenty-eight years ago. His wife and two children survive him.

DR. A. M. ADSIT

Dr. A. M. Adsit of Hastings died June 18th at the St. Joseph's Hospital following an operation for gall stones.

OF GENERAL INTEREST

Dr. F. A. Allen, of Crosby, has moved to Ironton.

Dr. T. E. Flynn has resumed his practice at Morgan.

Dr. Geo. D. Rice has resumed his practice in St. Cloud.

Dr. Spurbeck of Cloquet will locate at Webster, S. D.

Dr. R. S. Forbse, West Duluth, has returned from the service.

Dr. G. R. Pease of Redwood Falls has retired from practice.

Dr. R. L. Spinks of Middle River has been promoted to a captain.

Dr. J. T. Schlesselman of Mankato has gone East to take post graduate work.

Dr. Wm. J. Ecklund has returned from overseas and is now located in Duluth.

Dr. A. F. Hunte has received his honorable discharge and has returned to Madelia.

Dr. W. M. Chowning has resumed his practice at 716 La Salle Bldg., Minneapolis.

Dr. G. E. McCann has received his honorable discharge and has returned to Nevis.

Lieut. Col. B. W. Kelly received his honorable discharge and returned to Aitkin.

Dr. C. D. Richmond has received his honorable discharge and has returned to Jeffers.

Dr. W. B. Wright, Jr., of Chicago, will have charge of the Rood Hospital at Chisholm.

Capt. E. H. Marcum has returned from France and has resumed his practice at Bemidji.

Dr. F. A. Engstrom has received his honorable discharge and will locate in Wanamingo.

Dr. Ward C. Zeller of Union City, Indiana, will be associated with Dr. Allen at Ironton.

Dr. J. D. Watson has received his honorable discharge and has returned to Holdingsford.

Dr. W. J. Stock of Waconia has returned from overseas and has resumed his practice.

Dr. C. H. Ghent has received his honorable discharge and will locate at Third and Maria, St. Paul.

Dr. A. L. Gleason, City and County Hospital, St. Paul, will locate in Great Falls, Montana.

Dr. Fred B. Coleman who has been in the service of the United States Army has returned to Austin.

Dr. F. H. Gambell of Thief River Falls has sailed for Siberia where he will engage in Red Cross work.

Dr. C. R. Stanley of Ely has moved to Fulda and has entered partnership with Dr. F. W. Metcalf.

Dr. E. R. Sather has returned to Spring Valley after having served with the Medical Corps overseas.

Dr. J. C. Michael, St. Paul, is now at Camp Hospital 4 in a suburb of Paris. Dr. Michael is now a Captain.

Dr. George F. Eusterman of Rochester was married in June to Miss Ethel Huntimer of Glen Rapids, S. D.

Dr. C. E. Henry returned to Minneapolis after having served fourteen months on the hospital ship Solace.

Dr. Franklin Raiter, who has served in the Medical Corps of the United States Army has returned to Cloquet.

Dr. C. A. Fjelstad, Austin, will go to New York to take special work, after which he will locate in Minneapolis.

Dr. W. W. Lewis has received his honorable discharge and has resumed his practice in the Lowry Bldg., St. Paul.

Lt. Col. J. S. White has returned from service abroad and is opening his office at 1144 Lowry Building, St. Paul.

Dr. F. E. Burch, who has been the commanding officer of the Base Hospital at Camp Dodge, has returned to St. Paul.

Dr. John T. Litchfield has returned to Minneapolis after having served for a year on the United State hospital ship Solace.

Dr. F. M. Manson has returned to Worthington after having served for nearly two years in the Medical Corps of the United States Army.

Dr. W. W. Klima, who has had charge of the practice of Dr. T. J. Trutna, Glencoe, while the latter was in the service will locate at Stewart.

Dr. E. M. Hammes has resumed his practice in the Lowry Bldg., St. Paul, after having served in the Medical Corps of the United States Army.

Dr. Richard Cranmer, who has recently returned from eighteen months service in the A. E. F., resumed practice in the Syndicate Bldg., Minneapolis.

Major Paul F. Brown has returned to Minneapolis after ten months service at the front in France and Belgium. He will resume his practice at 1101 Met. Bank Bldg.

Dr. Wm. W. Moir has returned from service with the United States Army in Siberia and reopened his offices at the corner of Nicollet Avenue and Lake Street, Minneapolis.

Dr. R. E. Swanson, who recently returned from France after one year and eight months of medical service in the United States Army, has become associated with Dr. Haskell of Alexandria.

Dr. Walter J. Marcey of Minneapolis has returned after serving for sixteen months overseas for the Red Cross in France and Switzerland where he was engaged in the care of tubercular patients.

The following men have been elected to Alpha Omega Alpha, honorary medical scholarship fraternity, from the senior medical class: Wendell Lanphear Downing, Swan Ericson, Manley Hewitt Haynes, Siegfried Frederick Herrman, Hugh Toland Jones, Thomas James Kinsella, Russell Wright Morse, Martin Daniel Ott, Faus Peter Silvernale, Edgar H. Norris, Wm. Ray Shannon.

The following physicians have been elected to honorary membership during the past year: Drs. Chas. Lyman Greene, J. C. Litzenberg and J. P. Sedgwick.

NEW AND NON-OFFICIAL REMEDIES

During May the following articles have been accepted by the Council on Pharmacy and Chemistry for inclusion with New and Non-Official Remedies:

Abbott Laboratories:

Liquor Hypophysis, U.S.P. Abbott.

Procaine Hypodermic Tablets $\frac{3}{4}$ grain.

Procaine-Adrenalin Hypodermic Tablets—Abbott.

Gilliland Laboratories:

Antimeningococcic Serum (Combined Type) (Gilliland).

Diphtheria Antitoxin, Concentrated and Refined.

Tetanus Antitoxin, Concentrated and Refined.

Antipneumococcus Serum Type I.

Small Pox Vaccine.

Original Tuberculin "O.T."

E. R. Squibb and Sons:

Protargentum—Squibb.

NEW AND NON-OFFICIAL REMEDIES

Atreol.—An aqueous solution containing as its principal constituent the ammonium salts of a mixture of organic acids containing nitrogen in the sulphonic radical which results from the action of sulphuric acid on certain petroleum distillates. Atreol is applied locally for promoting the absorption of swellings and effusions in contusions following fractures, etc. It is claimed to be useful in dermatologic and gynecologic practice. It may be used in aqueous solutions, ointments and suppositories. The Atlantic Refining Co., Philadelphia, Pa. (Jour. A. M. A., May 17, 1919, p. 1463).

Gilliland's Concentrated and Refined Diphtheria Antitoxin.—Marketed in ampules containing 1,000, 5,000 and 10,000 units each. For a description of Diphtheria Antitoxin, Concentrated, see New and Non-Official Remedies, 1919, p. 280. Gilliland Laboratories, Ambler, Pa.

Gilliland's Concentrated and Refined Tetanus Antitoxin.—Marketed in ampules containing 1,500, 3,000 and 5,000 units each. For a description of Tetanus Antitoxin, Concentrated, see New and Non-Official Remedies, 1919, p. 266. Gilliland Laboratories, Ambler, Pa.

Gilliland's Antipneumococcus Serum, Type I.—Marketed in vials containing 100 cc.; also in double ended vials containing 50 cc. each, with a gravity injection apparatus for intravenous injection. For a description of Antipneumococcus Serum, see New and Non-Official Remedies, 1919, p. 271. Gilliland Laboratories, Ambler, Pa.

Gilliland's Small-Pox Vaccine.—Marketed in sealed capillary tubes in packages containing two tubes each. For a description of Vaccine Virus, see New and Non-Official Remedies, 1919, p. 274. Gilliland Laboratories, Ambler, Pa.

Gilliland's Original Tuberculin, "O.T."—Marketed in 3 Cc. vials. For a description of Old Tuberculin, see New and Non-Official Remedies, 1919, p. 2771. Gilliland Laboratories, Ambler, Pa. (Jour. A. M. A., May 17, 1919, p. 1463).

Barbital-Abbott Tablets 5-Grains.—Each tablet contains 5-grains of barbital-Abbott (see New and Non-Official Remedies, 1919, p. 82). The Abbott Laboratories, Chicago.

Procaine Hypodermic Tablets, $\frac{1}{2}$ -Grain.—Each tablet contains $\frac{1}{2}$ -grain of procaine-Abbott (see New and Non-Official Remedies, 1919, p. 30). The Abbott Laboratories, Chicago.

Procaine-Adrenalin Hypodermic Tablets.—Each tablet contains procaine-Abbott $\frac{1}{2}$ -grain and adrenalin 1-250-grain (see New and Non-Official Remedies, 1919, p. 30). The Abbott Laboratories, Chicago (Jour. A. M. A., May 17, 1919, p. 1463).

Protargentum-Squibb.—A compound of gelatin and silver containing approximately 8 per cent of silver in organic combination. It has the actions and uses of silver preparations of the protargol type (see New and Non-Official Remedies, 1919, p. 307). Protargentum-Squibb is used in 0.25 to 5 per cent. aqueous solutions, prepared freshly as required. E. R. Squibb and Sons, New York (Jour. A. M. A., May 24, 1919, p. 1543).

Antimeningococcic Serum (Combined) (Gilliland).—Marketed in 15 Cc. and 30 Cc. ampules and in 15Cc. and 30 Cc. cylinders with attachments for spinal administration. For a description of Antimeningococcus Serum, see New and Non-Official Remedies, 1919, p. 270. Gilliland Laboratories, Ambler, Pa. (Jour. A. M. A., May 24, 1919, p. 1615).

PROPAGANDA FOR REFORM

Phosphorus Metabolism.—The more recent investigations on digestion and absorption all point to the probability that phosphorus from the digestive tract reaches the general circulation only in the form of inorganic phosphates and that all organic phosphorus compounds are synthesized in the body cells. This is in support of the conclusion of the Council on Pharmacy and Chemistry in forming an estimate of the therapeutic potency ascribed to preparations of organically bound phosphorus, such as lecithin, glycerophosphates, phytin, nucleic acid and phosphoproteins. All the newer researches give no indication that the body is dependent on a ready made supply of phosphatid (phosphorized fat) in the diet to maintain normal nutrition (Jour. A. M. A., May 3, 1919, p. 1294).

Iodex.—Iodex is a black ointment marketed by Menley and James with the claim that it is a preparation of free or elementary iodine minus the objectionable features that go with free iodine. As a result of an investigation of Iodex made in the A. M. A. Chemical Laboratory, the Council on Pharmacy and Chemistry reported in 1915: 1, The composition is incorrectly stated; the actual iodine content is only about half of that claimed. 2, The action of Iodex is not essentially that of free iodine, although that is the impression made by the advertising. 3, The assertion that iodine may be found in the urine shortly after Iodex has been rubbed

on the skin has been experimentally disproved. As the manufacture of Iodex still persist in their claim that the product contains free iodine, the A. M. A. Chemical Laboratory has again examined Iodex. It reports that Iodex gives no test for free iodine, or, at most, but mere traces (Jour. A. M. A., May 3, 1919, p. 1315).

Two Misbranded Nostrums.—Bull's Herbs and Iron Compound was a weak alcoholic solution containing iron, phosphates, sugar and vegetable derivatives, among which were quinine, red pepper, gentian and podophyllum. It was falsely and fraudulently represented as a remedy for weak nerves, ailments peculiar to women, scrofula, rickets, liver, kidney and bladder diseases, etc. Effervescent Granulare consisted of over 13 per cent. sodium bicarbonate, 61 per cent. of sugar, 3 per cent. of borax, and 17 per cent. potassium bitartrate. Though invoiced as "Eff. Magnesia" it contained no magnesia. Both were declared misbranded (Jour. A. M. A., May 3, 1919, p. 1316).

Collosol Manganese.—Stephens, Yorke, Blacklock, Macfie, Cooper and Carter report in the Annals of Tropical Medicine and Parasitology the results of their investigation for the English government of Collosol Manganese conclude that Collosol Manganese in the doses used is of no value in the treatment of simple tertian malaria (Jour. A. M. A., May 3, 1919, p. 1318).

Helpful Hints for Busy Doctors.—A comparatively recent issue of the International Journal of Surgery has an editorial on "The Questionable Etiology of the Present Epidemic," signed "G. H. Sherman, M. D." It was to the effect that one can best immunize against influenza by using "a combined vaccine containing the influenza bacillus, pneumococci, streptococci, the Micrococcus catarrhalis and staphylococci." In the advertising pages of the same issue was an advertisement of "Influenza Vaccine No. 38," which "Will abort Colds, Grippe, Influenza and Pneumonia," and which was made by "G. H. Sherman, M. D." The vaccine contained the various bacilli and cocci mentioned in the G. H. Sherman editorial. One wonders if in succeeding issues of the International Journal of Surgery one may look for editorials by the proprietors of Bellans, Phenalgin and other products advertised in the publication (Jour. A. M. A., May 10, 1919, p. 1371).

Administration of Arsphenamine.—The U. S. Public Health Service has issued a circular concerning the dilution and the rate of administration of arsphenamine solutions. A study as to the cause of the disagreeable results following the use of the various preparations of arsphenamine has indicated that most disagreeable results are not inherent in the preparations but are produced through faulty steps in the administration of the remedy, chiefly from the use of a too concentrated solution and by too rapid administration (Jour. A. M. A., May 10, 1919, p. 1372).

Lane's Asthma Cure.—The A. M. A. Chemical Laboratory reports that Lane's Treatment, double strength, for Hayfever and Asthma (formerly called Lane's Asthma Cure) was found to be essentially a solution of calcium iodide, alcohol and water, with vegetable extractives and sugar. It contained 3.96 Gm. of

anhydrous calcium iodid, or about 2.5 grains per dose. Iodids have been used for years in the treatment of certain forms of asthma. Under careful supervision the use of iodids in selected cases of asthma may give decidedly satisfactory results. Self dosing with iodids, however, is by no means free from danger (Jour. A. M. A., May 10, 1919, p. 1386).

Tyree's Antiseptic Powder.—An advertising leaflet for Tyree's Antiseptic Powder recently received by a physician is devoted largely to a report of a bacteriologic examination of the Tyree's preparation. The physicians who receive this advertising material might easily overlook the fact that the reported bacteriologic tests were made in 1889 and that the investigation of the Council on Pharmacy and Chemistry in 1906 brought out that the examination applied to a product differing radically in composition from that of the preparation now marketed. The Council found that although the Tyree preparation was advertised as a mixture of borax and alum, it was essentially a mixture of zinc sulphate and boric acid. Here then we have a manufacturer publishing in 1919, in behalf of a certain product, tests that were made in 1889 with a product of different composition although of the same name (Jour. A. M. A., May 17, 1919, p. 1482).

Peptenzyme.—Peptenzyme was reported on by the Council on Pharmacy and Chemistry along with a number of other products of Reed and Carnrick in 1907. The report "Reed and Carnrick's Methods" announced that none of the products examined were eligible for New and Non-Official Remedies. The following is an abstract of the report on Peptenzyme: Peptenzyme elixir and powder are said to contain "the enzymes and ferments of all the glands which bear any relation to digestion"; therefore, the peptic glands, pancreas, salivary glands, spleen and intestinal glands. The preparations are said to be "not chemical extracts, but pure physiologic products." Apparently Peptenzyme powder consists of the glands, dried and powdered, while the elixir is an extract. It is stated that these preparations digest proteids, starch and fat, and in addition stimulate and nourish the digestive glands, and that the ferments in these preparations do not interfere with or digest one another. Examination by the Council showed that these preparations were practically devoid of any power to digest proteids or fat when tested by the U. S. P. method. The claim that the product contained ferments which would not show this activity in the test tube, but become active in the elementary canal, is contrary to known facts and could not be substantiated by the manufacturer. The claims made for Peptenzyme powder and elixir were held to be unwarranted. (Jour. A. M. A., May 17, 1919, p. 1484).

Kline's Nerve Remedy.—This epilepsy nostrum was analyzed by the A. M. A. Chemical Laboratory and found to be a bromid preparation and practically identical with Waterman's Tonic restorative.

Chase's Rheumatic Specific.—The A. M. A. Chemical Laboratory found this to have essentially the following composition: Sodium salicylate 22.4 per cent., magnesium oxid 5.3 per cent., licorice root 72.3 per cent.

Diabetol.—In 1910 Professor Millsbaugh at the Field Museum, Chicago, found this herb to be from a shrub—*Stenolobium stans* (L.)—growing in Arizona, Mexico and Central America.

Varnesis.—Some time ago, the State chemists of Connecticut found this to contain 18 per cent. alcohol and less than 1 per cent. vegetable extractives derived from laxative drugs and capsicum. Later the alcohol percentage was reduced to 15.

Viavi.—Viavi Capsules were analyzed for the California State Medical Journal and reported to contain nothing but extract of hydrastis and cocoa butter.

Nuxated Iron.—The analysis in the A. M. A. Chemical Laboratory indicated that Nuxated Iron Tablets contained only 1-25 grain of iron, while the amount of nux vomica was practically negligible. Nuxated Iron has been advertised by an extensive campaign of misrepresentation and exaggeration (Jour. A. M. A., May 24, 1919, p. 1560).

Sanosin.—Sanosin (first introduced as Sartolin) consists of a mixture of powdered eucalyptus leaves, flowers of sulphur, powdered wood charcoal, and oil of eucalyptus. The instructions to the consumptive are that this mixture should be placed on a slab under which an alcohol lamp is burning. The whole thing is to be operated in a room which is tightly closed and in which the consumptive is supposed to stay (Jour. A. M. A., May 24, 1919, p. 1561).

Town's Epilepsy Treatment.—This is a bromide epilepsy preparation and was analyzed by the A. M. A. Chemical Laboratory (Jour. A. M. A., May 24, 1919, p. 1561).

The Williams Treatment.—According to the Dr. D. A. Williams Company, which sells it on the mail order plan, the Williams Treatment "conquers kidney and bladder diseases, rheumatism and all other ailments when due to excessive uric acid." The Williams Treatment was analyzed in the A. M. A. Chemical Laboratory and from the results of the examination it was concluded that it is essentially a mixture containing in 100 Cc. 48 Gm. potassium acetate in solution and about 7 Gm. potassium bicarbonate, the latter being largely undissolved. The mixture is colored with caramel and flavored with oil of wintergreen or methyl salicylate (Jour. A. M. A., May 31, 1919, p. 1632).

Investigation Based on False Premises.—One sometimes reads in supposedly "Original Articles" in medical journals statements that seem puzzlingly familiar. If one is sufficiently inquisitive and possessed of a germ of Sherlock Holmesism, the familiar statement may be traced to the "literature" for some proprietary medicine with which the author's article deals. The unwisdom of authors accepting the unconfirmed statements of the promoters of proprietary remedies is well illustrated in a recent report of the Council on Pharmacy and Chemistry on "Collosol Cocaine," a preparation claimed to contain 1 per cent. of cocaine in colloidal and relatively nontoxic form. The report brings out that men of good standing had reported "Collosol Cocaine" to be much less toxic than cocaine. These men, however, did not verify the statement of its composition, and subsequent investigation by others brought

out the fact that "Collosol Cocaine 1 per cent." contained but 0.26 per cent. cocaine, and that its toxicity was in accord with the amount of cocaine found. Those who investigate the action of drugs must recognize more fully than has often been done in the past, that a study of a medicament is of no scientific value whenever the identity of the substance is not established. (*Jour. Ind. State Med. Assn.*, May 1919, p. 135).

Therapeutic Evidences.—Has the medical profession learned to distinguish between real therapeutic evidence and chance observation? If so, the profession will not be impressed by certain testimonials for a widely advertised ointment. The wise physician who reads the testimonials will ask: Was it the "baking" or the proprietary ointment which produced the "remarkable results" in "rheumatic affections and ankylosis"? Was the "contracted arm chronic" benefitted by time and friction or by the proprietary? How did the physician know that "anointing the nostrils" prevents attacks of influenza? Those who are inclined to give credit to drugs for naturally occurring events may be interested in the statement of a prominent chemist that he has been free from his periodical colds since he arranged for an inoculation with a "cold" vaccine but was prevented from keeping the appointment (*Penn. Med. Jour.*, May 1919, p. 524).

PROGRESS IN MEDICINE AND SURGERY

PUPILLARY STUDIES, WITH SPECIAL REFERENCE TO ANISOCORIA: Wm. Tarun, M. D., (*Trans. Amer. Ophth. Soc.* 1917, vol. xv, p. 301). Tarun has investigated the frequency and diagnostic value of inequality of the pupils, and to this end has examined records of 3,610 private patients suffering from non-inflammatory affections of the eyes. Examinations were made in a dark room with a constant source of light. The reaction of the pupil was determined with a concave mirror, used at a distance of rather more than its focal distance. Anisocoria was looked for under the same conditions with a plane mirror, at a distance of one metre from the patient. In Tarun's opinion, the daylight test should be discarded. The examination of the pupils should be made under quiet conditions, in order to exclude the psychic reflex. Two minutes should be allowed for dark adaptation. The author feels sure that on occasion Haab's cortical pupillary reflex has been mistaken for an Argyll Robertson pupil. Anisocoria was found in 19.39 per cent. of the cases examined. Normal eyes average 18.54 per cent., which gradually rose in diseased eyes and lesions of the nervous system until 70 per cent. was reached in the instances of Argyll Robertson pupil. Tarun is rather sceptical in believing that there is such a condition as physiological anisocoria, although Bach and Behr think it does exist. "In view of the percentage of anisocoria in the normal eyes there must have been some condition present, eliminating a toxin, during the lifetime of the individual, acting not upon the motor supply of the sphincter muscle of the iris, but upon the sympathetic fibres to

the dilator pupillae." Tarun believes that inequality of the pupils is of scanty value when the pupils are active to light, when there is merely a slight difference in size, and even in some cases when a marked difference exists. When there is a slight difference in size, together with inactivity to light, directly or consensually, it is of the utmost value in determining the site of a lesion of the cerebro-spinal axis. It is useful at times when one pupil or both pupils are not uniformly round and sluggishly active.

The communication ends with a bibliography containing thirty-three entries. CARL L. LARSEN.

SACROILIAC RELAXATION OR SEPARATION. J. Torrence Rugh, M. D., (*Therap. Gaz.*, Dec. 15, 1916).

The author reviews the causes, symptoms, diagnosis and treatment of sacroiliac relaxation or separation.

He states the laity are willing to take up with the diagnosis of this condition, because they so readily understand just what has happened. He believes that X-ray examination is of very little help in diagnosis, when a true relaxation has occurred.

Tuberculous disease of the sacrum or ilium, pyogenic infection of the bones or joints, chronic sprains of the back, sciatica, congenital malformations of the fifth lumbar vertebrae, sarcoma and appendicitis must be differentiated from this condition. The differential diagnosis is sometimes difficult, except through therapeutic test of strapping after manipulation and reduction of the part.

Treatment:

I. Reduction, either under an anesthetic or without, by flexion or extension of the thigh.

II. Adhesive tape below the anterior superior spine, firmly strapped to the pelvis. Occasionally corsets, plaster-paris jacket or steel braces are necessary.

III. Sometimes bone-graft from ilium to sacrum is resorted to. C. C. CHATTERTON.

BOVINE TUBERCULOSIS IN CHILDREN: R. S. Austin, M. D. (*American Journal Diseases of Children*, April, 1919). Austin analyses 24 cases of tuberculosis in children and infants with reference to the bovine or human type of infecting organism. The ages ranged from 2½ months to 11 years, all but three died and 14 were autopsied.

Determination of the type of bacillus was based on the result of inoculations of rabbits with known amounts of culture.

His results show seven of the twenty-four to be infected with the bovine type of tubercule bacillus. The three living cases, one of human type and two of bovine are cases of bone or joint tuberculosis apparently localized. There is little indication regarding higher or lower percentage of bovine infection at different age periods. One out of nine under two years showed bovine infection and all seven of bovine type are under six years. While this is a small series he thinks that finding seven out of twenty-four cases to be caused by bovine type of organism emphasizes the importance of this variety of the tubercule bacillus in tuberculosis of children; and, as it is generally considered that bovine

infection is through cows milk the fact that these seven cases occurred in Chicago where all milk is supposed to be pasteurized, points to the necessity of home pasteurization.

W. D. BEADIE.

THE EYESIGHT OF THE NEGRO OF AFRICA: Dr. J. N. Roy (Arch. of Ophth. vol. XLVIII, No. 1) who during a recent tour throughout Africa visited twenty-two different colonies studied anatomically, physiologically and pathologically the eye of five thousand negroes of one hundred different tribes.

In his investigation of the visual activity in the black man, he employed de Wecker's chart placed at a five meter distance and retinoscopy. Because of the very bright light and clearness of atmosphere in the Dark Continent an emmetropic eye which in northern countries would have a vision of 5.5 or even 6.5 would in Africa obtain 7.5 vision. A visual activity of 7.5 was therefore taken as normal sight in that country or tropical places.

A survey of the geography and ethnology of Africa demonstrates that different races come in more or less intimate relationship through association, intermarriage and wars. Where these relationships are most evident, inherited disease results as a consequence, namely syphilis, trachoma, purulent ophthalmia and small pox. It may be said in general that those people living north of the fifth degree latitude suffer more from ocular disease from the causes above enumerated than do those living south of this line.

An examination of the eyes of negroes discloses a marked degree of pigmentation; the iris and choroid and at times the ocular conjunctiva opposite the external canthus are saturated with it. A physiological condition of melanosis of the soft palate and gums is not infrequently demonstrable.

Emmetropia is almost the constant finding in the African blacks, the average vision of the natives being 12.5. One patient affected with sleeping sickness had a visual activity of 20.5. At this point the author comments upon the great resistance of the African to human trypanosomiasis. Simple myopia was found in the proportion of about 1.5 per 100; myopic astigmatism 1.5 per 100; simple hypermetropia and hyperopic astigmatism 2.5 per 100. In simple myopia the author never used a glass higher than 4 diopters, in myopic astigmatism a cylinder never higher than -2.5; in simple hypermetropia a sphere never higher than +2.5. In no other race is the ability to see to great depth in water so nicely developed. In spite of the most careful researches the writer was unable to discover a single case of alteration in color vision or hemianopsia; keratoconus and keratoglobus are in Africa non-existent.

Experimentally, Dr. Roy has proven that the African negro sees at night two to four times better than whites, which in his opinion is accounted for by the fact that the natives employ their eyes after dark to a greater extent than do the Caucasians.

Another fact worthy of note brought forward by the author: native Africans have a greater power of accommodation. Unfortunately his experiments were conducted only upon individuals between 13 to 30 years of age.

The higher the human being arises in the social scale the more man's brain is developed at the expense of the organs of special sense, especially vision and hearing, the author states in conclusion. Sight and hearing in the civilized become defective because of strong artificial light and injurious noises. Diathesis is transmitted from generation to generation and excesses of all kinds are indulged in. The African negro must pay the price for civilization.

P. D. BERRISFORD.

BASAL-CELL EPITHELIOMA*: A. C. Broders, M. D., Mayo Clinic, Rochester, Minn. (Jour. Am. Med. Ass'n., 1919, 72,856).

The cases of basal-cell epithelioma in the present series represent 13.4 per cent of 2,000 cases of general epithelioma.

Basal and squamous cells can be shown intimately connected in a neoplasm.

It seems to be a well-established fact that a basal-cell epithelioma can change into a squamous-cell epithelioma or at least into an epithelioma in which the squamous cells predominate.

The condition occurs more often in males than in females, the proportion being about three to two in favor of the former.

The disease occurs in patients past middle life; their average is 56.7 years.

It occurs more often in farmers than in any other class of people.

A family history of malignancy and a personal history of injury play a negligible part.

Previous mole, wart, pimple, excema, scab, ulcer, etc., are associated in 37.1 per cent of the cases.

The duration of the lesion shows a marked variation; it extends from three months to forty-five years, with an average of seven years and one month.

Ninety-six and twenty-eight hundredths per cent of all the lesions occur above the clavicle.

Thirty-six and nineteen hundredths per cent of all the patients were either operated on or treated with acids, carbon dioxide, etc., before entering the Mayo Clinic.

In approximately 75 per cent of all the cases treated at the clinic there was either one excision with the knife alone or one excision with the knife immediately followed by cautery.

Of the 54.1 per cent of patients heard from 75.86 per cent are living, of which 75.45 per cent report a good result.

In the cases in which a good result was reported 74.68 per cent of the patients had either one excision with the knife alone or one excision with the knife immediately followed by cautery.

The patients who had been treated with acids, carbon dioxide, etc., before entering the clinic did not get so good a result as those who had had no previous treatment.

The low grade of malignancy of the neoplasm is evidenced by its long duration, lack of metastasis in

*Abstract of paper presented before the meeting of the Southern Minnesota Medical Association, January, 1919, Mankato.

a single case in this series, response to proper surgical treatment, and by the fact that 75.45 per cent of the patients reported living have been free from the disease on an average of 6 years, 1.6 months.

Of the patients reported dead, fewer than one-third died from this disease.

The average greatest diameter of the tumors which did not recur after treatment was 1.75 cm.; of those which showed slight recurrence it was 2 cm., and in patients who were not improved by treatment, the average diameter of the tumor was 3.75 cm. The average greatest diameter of the lesion in patients known to be dead was 2.67 cm., while the average greatest diameter of the lesion in patients who died of basal-cell epithelioma was 4.32 cm.

Excessive exposure to sunlight as a cause of the neoplasm has not been borne out by the facts in our series of cases. It was noted that the hand, which is exposed to light at least as much as any part of the body above the clavicles, did not show lesions.

Practically all of the neoplasms in our series had their origin in the germinal layer of the epidermis of the skin; only one was demonstrated to have originated from a hair follicle.

A STUDY OF THE ETIOLOGY OF CHOLECYSTITIS AND ITS PRODUCTION BY THE INJECTION OF STREPTOCOCCI*: R. O. Brown, Division of Experimental Bacteriology, Mayo Foundation, Rochester, Minn.

The work reported by the author is similar to that done by Rosenow in 1914 except that all gall bladders removed at operation in the Mayo Clinic, regardless of the degree of pathologic changes, were cultured.

The tissues were cultured as soon as possible after their removal, every effort being made to prevent contamination. Immediately before emulsifying, the tissues were thoroughly washed in large volumes of physiologic sodium chloride solution. They were then ground in mortars within sterile air chambers or in a hood, the air of which was washed by means of steam from a sterilizer fastened to the end of the hood. The operator wore gloves and sleeves which, with the materials used, were sterilized in the sterilizers opening into the hood. The emulsions thus made were inoculated in varying concentrations into tall columns of dextrose brain broth, blood broth, litmus milk, ascites dextrose broth, ascites dextrose agar and dextrose agar. Krumwiede plates of dextrose blood agar and plain blood agar plates were poured also. The cultures were studied at the end of twenty-four hours, but those that were negative were examined daily for a week.

Altogether, cultures were made from seventy gall bladders and four ulcers. At first cultures were also made from the contents of the gall bladders, but because of the large number of negative results, regardless of the findings in tissues, this was abandoned.

The duration of the symptoms in the cases studied ranged from three months to thirty years. The pathologic changes ranged from slight to marked thickening of the walls.

*Abstract of paper to be published in the Arch. Int. Med., 1918.

In the gall bladders showing slight changes 30 per cent only yielded streptococci, in contrast to 75 per cent in those showing marked changes. Moreover, the gall bladders in which marked changes existed showed the larger number of colonies. Some of these contained countless numbers of organisms, while those showing slight changes, with few exceptions, contained a small number. Of the latter 58 per cent gave no growth, while only 25 per cent of those showing marked changes gave no growth. In the cases showing slight changes, colon bacilli were isolated in pure culture from 12 per cent and in combination with streptococci from 6 per cent. The entire 15 per cent of those with marked changes contained both colon bacilli and streptococci.

Some of the organisms, when first isolated, produced opaque, indifferent colonies on blood agar, and microscopically were grouped in diplococcus forms with little or no chain formation. Further study, however, proved them to be streptococci. In this connection an interesting observation was made. From one of these cases, showing a pure culture of opaque gray staphylococcus-like colonies, two strains derived from a single colony were studied. The one kept on blood agar alternately aerobically and anaerobically became a green-producing streptococcus. The other, planted alternately in dextrose brain broth and on aerobic and anaerobic blood agar slants, developed hemolytic powers.

The different strains varied somewhat in their fermentative powers. Of the eighteen studied, all fermented dextrose, lactose and maltose, three raffinose, four mannite, ten salicin and one inulin. One strain, after a single animal passage, had its fermentative powers changed, but it was still agglutinated, the same as the original strain.

Microscopic examination of the gall bladders failed to reveal bacteria when negative cultures were obtained, but bacteria were found consistently when the cultures were positive. Organisms were found in the lesions produced in rabbits, but were not found in normal tissues. At the suggestion of Dr. E. S. Judd, microscopic examination of liver sections which he removed were made in ten cases. Interlobular cirrhosis was found in six, no change in two, and a bile-duct involvement in two. The livers which were normal and those showing fibrotic changes, were found in cases in which the gall bladders showed marked and slight changes, while in those showing cholangitis there was little or no change.

EXPERIMENTAL SURGICAL SHOCK*: F. C. Mann, M. D., Division of Experimental Surgery and Pathology, Mayo Clinic, Rochester, Minn.

The writer reviews the results of the investigations of experimental surgical shock with special reference to the phases bearing on its relation to anesthesia. It is emphasized that the condition termed shock by the surgeon is undoubtedly due to a large number of causes, and that experimentally, it is very difficult to reproduce the environment and all the phenomena that a surgeon calls shock. The kinds of shock the

*Abstract of paper presented before the Seventh Annual Meeting of the American Association of Anesthetists, Atlantic City, June, 1919.

anesthetist is interested in are discussed. The methods of producing experimental shock and the probable factors involved are considered. All cases of shock appear to be capable of classification into one or two divisions. (1) Those cases in which the condition develops immediately after the exciting agent, and (2) those in which an interval of time elapses before the development of the condition. In the first group, the nervous system is probably the main factor in the cause, and inhibition seems to be of more importance than excitation. In the next group, the end result, and probably the cause of symptoms, is a loss of circulating fluid. In all probability many factors can produce this loss of fluid. With regard to treatment, it is noted that the transfusion of blood appears to give better results than any other method.

AN EXPERIMENTAL STUDY OF THE EFFECTS OF DUODENECTOMY. A PRELIMINARY REPORT*:

F. C. Mann and K. Kawamura, Division of Experimental Surgery and Pathology, Mayo Clinic, Rochester, Minnesota.

The author's investigation was undertaken for the purpose of determining the effects of the removal of the duodenum. Previous work on the problem has been reviewed. The anatomy, physiology, and pathology of the duodenum, and their relation to the extirpation of the organ are discussed. A one stage operation for the removal of the duodenum was developed. The duodenum was removed from the dog, cat, hog, goat and monkey. Careful studies on the dog did not reveal any noticeable changes following the duodenectomy. The animals remained in good condition. Examination of the blood showed it to be normal with regard to cell counts, hemoglobin, carbon dioxide combining power and hydrogen ion concentration. The X-ray showed the course of a standard barium meal to be practically the same as in a normal dog. Experiments on the other species have been too recent to allow conclusions to be drawn but it would seem that the removal of the duodenum in the hog is as innocuous as is its removal in the dog. No data have been secured to show that the duodenum is of great importance in any of the species used. Future studies may give more positive results.

HEMATOGENOUS INFECTIONS OF THE KIDNEY:

William J. Mayo, M. D. (Abstract of paper presented at A. M. A. Session June 1919). Bright's disease involves both kidneys and occurs in two forms which are often confused: Type one, so-called acute parenchymatous nephritis, and Type two, the chronic interstitial nephritis. Type one is a true nephritis involving the kidney filter chiefly and is caused by specific toxins the result of infections usually derived from lesions of the skin and mucous membranes, for example scarlet fever and diphtheria. The kidneys are large, white, and soft. In the acute phase edema from chlorid retention is frequent. The urine is loaded with albumin, casts, and

blood corpuscles. Sometimes the disease begins subacutely and pursues a chronic course with irregular deposits of connective tissue in the kidney, and sometimes Type one nephritis is grafted on the chronic contracted organ (Type two), causing confusion of type.

The chronic form (Type two) which involves the connective tissue and blood vessels chiefly is not a true nephritis. Its cause, so far as is known, is not connected with infections, and the disease is incurable. The kidneys are contracted, hard and granular from deposits of connective tissue. The vascular system is always involved to a greater or less extent, and the heart is so often affected as to make the appellation of cardiorenal disease appropriate in some cases. The urine is usually clear and abundant, especially at night; it is of low specific gravity and sometimes contains albumin and casts. The clinical course of the chronic form is marked by hypertension and uremia from retention of urea and other compounds. The disease may exist in the latent form for many years.

Hematogenous infection of the kidney causes a third type of nephritis which, in its chronic form, has in the past been confused with Bright's disease, and in the acute form with inflammatory conditions in the abdomen. Hematogenous nephritis is an infection with living microorganisms. The disease may involve the kidneys unequally, or it may be unilateral. Congenital or acquired defects in a kidney render it more vulnerable to the infecting agents which vary greatly in virulence. In the fulminating forms, if both kidneys are involved, as with streptococcus, death results; if the involvement is unilateral, early nephrectomy may save life. In the subacute forms septic infarcts and cortical abscesses may necessitate nephrectomy, or the spontaneous evacuation of a cortical abscess in the fatty tissues may lead to a peri-nephritic abscess, or the whole kidney may be destroyed, causing a pyonephrosis. Since the cause of hematogenous nephritis is a pus-producing coccus of relatively short life, no living organisms may be found in the later stages and the varying results of the infection-scar tissue and other evidences introduced in the process of repair of the damage—may produce confusing pictures to the pathologist, especially if the infection is implanted on a kidney already the subject of Bright's disease.

In many instances the kidney may recover its function and after this process, if painful scars remain, the pain may be relieved by capsulotomy. At times carbonate of calcium is deposited in the infected area in the process of cure; this produces x-ray shadows which may be mistaken for the ordinary kidney stone. The surgeon today is as much interested in the pathology of the kidney as is the internist, and the surgeon's work tends to bring forward the pathology of the kidney in the living for comparison with the clinical findings. Heretofore attempts have been made to correlate the clinical with the post-mortem findings which often do not show the true condition during life but rather the terminal condition which caused death.

CANCER OF THE STOMACH: Charles H. Mayo, M. D. (Abstract of paper presented before Am. Surg. Assn. June 1919). The greatest number of cancers come in the area of highest acidity, the stomach. More than

*Abstract of paper presented before the Section of Pathology and Physiology at the Seventieth Annual Session of the American Medical Association, Atlantic City, June 9-13, 1919.

one-third of the cancers in men and more than one-fifth of the cancers in women appear in this organ. Ninety-eight per cent of intestinal cancers are in the colon, while cancer in the small intestine is rare, about 2 per cent.

In taking a general survey of the various theories and reviewing the clinical evidence concerning the etiology of gastric cancer, it seems that not one but several conditions are essential to its development. The change from the normal to the cancer cell is not great. In a general way it may be said that the nucleus is proportionately larger in the cancer cells than in the normal cells and is ready for division with less than the average amount of cytoplasm surrounding it. When some cell exhausts its controlling granules in division, and reverting to primitive life, becomes parasitic, we may have the beginning of cancer, but only if other factors are present, such as acid condition, which undoubtedly stimulated cancer growth, or greatly lowered alkalinity. It is reasonable to assume concerning the normal division of a cell that the brain directing its division comes from the centrosome; possibly other granules may serve this purpose.

From October 1, 1897, to January 1, 1919, 2094 operations for cancer of the stomach were performed at the clinic. Seven hundred thirty-six of these were resections with a mortality of 13.7 per cent, 746 were explorations with a mortality of 2.9 per cent, and 612 were palliative operations with a mortality of 11.1 per cent. The common type of operation was the Mikulicz, Hartmann, Billroth No. 2, of which there were 359 with a mortality of 12.5 per cent. There were 19 of the Billroth No. 1 type with a 5 per cent mortality, 28 sleeve resections, and 7 Kocher operations with a mortality of 14.2 per cent each, 115 posterior Polya operations with a mortality of 14.7 per cent, and 120 anterior Polyas with a mortality of 13.3 per cent. The local resections, 12 in number, gave the highest mortality, 25 per cent. These 660 resections have been done since 1906. Prior to this the type of resection was not described in the records definitely enough to be included in a statistical report.

For the last three years the anterior instead of the posterior Polya operation has been done in the clinic. Better after results seem to be obtained by turning the bowel to the right, isoperistaltic, by closing the end of the stomach toward the lesser curvature, and protecting the closed portion by suturing the unopened bowel over it.

Four hundred twenty-seven patients were operated on during the three years previous to September, 1917. Those who died in the hospital and those not heard from number 121. Those who recovered from the operation and who have been heard from number 306; 115 (37.6 per cent) of these show three year cures. Three hundred thirteen patients were operated on during more than five years before September first, 1917. Those who died in the hospital and those not heard from number 79. Those who recovered from the operation and who have been heard from number 234; 59 (25 per cent) of these show five year cures. This is a most satisfactory showing for the surgical relief of an otherwise hopeless condition which is attended by much suffering.

CLINICAL OBSERVATIONS CONCERNING THE FRAGILITY OF ERYTHROCYTES: H. Z. Giffin, M. D. and A. H. Sanford, M. D., Rochester, Minnesota (Abstract of paper presented before the American Society for Clinical Investigation, Atlantic City, N. J., May 6, 1919. To be published in *Jour. Lab. and Clin. Med.*, 1918.) Considerable confusion concerning the fragility of erythrocytes in various clinical conditions has been the result of (1) the different methods used in making the test. (2) the reporting of small groups of cases, and (3) the failure to make a control test with each test or each group of tests. The method used in the authors series of cases is a simplification of the Ribierre test. The use of a control has proved to be necessary first, in order to test the accuracy of the hypotonic salt solution, and second, in order to have a more accurate method of comparison for judging definite increases of fragility or increases of resistance. The use of a fixed normal leads to considerably more inaccuracy.

The series tested includes 225 cases. The groups of secondary anemia and pernicious anemia corroborate former reports showing a normal resistance or a definitely increased resistance in these cases. Fourteen cases of splenic anemia, carefully selected, showed a very definitely increased resistance. One patient, two years and ten months after splenectomy revealed a very marked increase of resistance. Twelve cases of myelocytic leukemia showed a very striking adherence to normal resistance; no case of this group showed a definite increase of fragility or an increase of resistance. Twenty-five cases of hemolytic jaundice showed a definitely increased fragility. One patient only in the group showed a normal resistance; this was in a definite, though mild, case. In two cases of hemolytic jaundice, even though the age of the patient at onset was approximately 20 years, one parent revealed an increased fragility, indicating a probable hereditary factor in cases which might otherwise be classified as acquired. Twelve patients with hemolytic jaundice, after splenectomy showed the same definitely increased fragility as compared with controls, although in certain individual cases there seemed to be a slight decrease of the degree of fragility.

The test for fragility of erythrocytes in hypotonic salt solution is of definite practical value especially in the diagnosis of all those diseases which may simulate hemolytic jaundice. It is more accurate when compared with a control test of normal blood.

INTRANASAL DRAINAGE OF THE LACRYMAL SAC: J. V. Paterson, M. B. F. R. C. S. and J. S. Fraser, M. B. F. R. C. S. (*The Brit. Jour. of Ophthal.* May 1919, Vol. 111, No. 5) report very fine results by this method of treatment in a series of 50 consecutive cases from which it is deduced that the intranasal method of treating chronic dacryocystitis surpasses the more drastic method of complete excision of the tear sac. The authors state that it requires at most fifteen minutes to perform the intranasal operation.

Often a troublesome epiphora exists after excision of the sac. If then by proper drainage into the nares a chronic dacryocystitis can be cured, the operation of choice in the future must be that devised by West or some modification of same. **GEORGE C. DITTMAN.**

BOOK REVIEWS

SURGICAL CLINICS OF CHICAGO. (April 1919, vol. 3, No. 2. W. B. Saunders Co., Philadelphia. \$10.00 per year).

A well balanced number with several articles of more than ordinary interest. Bevan discusses at some length the ordinary clinical side of appendicitis with a summary of the historical side of the subject. Andrew's article on the multiple drilling of fractures shows that by this simple means many ununited fractures can be made to unite and thus makes unnecessary in numbers of cases the use of the bone graft or other operative means. The discussion of fracture of the carpal scaphoid by McCarty emphasizes the necessity of always being on the lookout for this common injury as many disabled wrists are directly due to the non-recognition of this condition. The other articles in the volume are all worth reading.

W. H. C.

A TREATISE ON ORTHOPAEDIC SURGERY. (Royal Whitman, M. D., M. R. C. S., Eng., F. A. C. S. 6th edition. Lea & Febiger. \$7.00).

This book has long been the standard text book of orthopedic surgery and the new edition only serves to further fix it in its well deserved position. Clean cut and concise it gives, as no other single volume does, the essentials of orthopedic diagnosis and treatment. The chapter on military orthopedics and reconstructive treatment is new and shows the advances made by this branch of surgery during the war.

W. H. C.

ANATOMY OF THE HUMAN BODY. (Henry Gray, F. R. S. 20th edition, thoroughly revised and re-edited by Warren H. Lewis, B. S., M. D. Lea & Febiger.)

The twentieth edition of this classical work brings the book up to date by adding "new matter in physiological anatomy, laws of bone architecture and mechanics and variations of muscles." The sections on the ductless glands and the nervous system have been largely rewritten and there has been a rearrangement of the sections on embryology and histology. For many years this book has been one of the best of anatomical text books and this new edition makes it more prominent than ever.

W. H. C.

ELECTRICITY IN MEDICINE. (George W. Jacoby, M. D. and J. Ralph Jacoby, A. B., M. D. P. Blakiston's Son & Co., Philadelphia. \$5.00).

In the employment of any therapeutic agent however specific in its action, a certain degree of empiricism must be admitted. This is particularly true in the application of electrical phenomena. However, a fundamental knowledge of the laws governing its use, a proper understanding of the instruments employed and a precise meaning for all expressions used are therefore prerequisites that should be mastered by one applying this agent. "Electricity in Medicine" is well written, amply illustrated and can be read with profit.

P. D. BERRISFORD.

THE OPERATIONS OF OBSTETRICS. (Frederick E. Leavitt, M. D. C. V. Mosby Co., St. Louis. \$6.00).

This book is the second of its kind by an American author. It contains 248 very excellent illustrations, a large number of them being original by the author; and has 441 pages of reading matter. Six years were consumed in its preparation and while parts of it were rewritten innumerable times, the entire manuscript was rewritten six times before it was given to the publishers. The style is pleasing, easy and direct, the author presenting the subject in the fewest words possible. He does not wander from his text and there is no space devoted to the consideration of etiology, theory, physiology, nor medical treatment and only enough to pathology to pave the way for a discussion of the surgical treatment. Conservation and a well balanced judgment display themselves throughout the whole work. A striking and very excellent feature is the discussion devoted to the question of prognosis for mother and child afforded by the various surgical procedures. Another feature is the concise table of statistics taken from the large European clinics. A careful reading of the whole volume revealed only two minute typographical errors. This is a timely and praiseworthy volume and merits a place in the library of every medical man.

A. G. SCHULZE.

NEW AND NON-OFFICIAL REMEDIES, 1919. (Price, postpaid, \$1.00. Chicago: American Medical Association, 1919.)

In this book are listed and described those proprietary remedies which stand accepted by the Council on Pharmacy and Chemistry of the American Medical Association and which should, therefore, merit consideration by the medical profession. The book also includes the newer nonofficial nonproprietary remedies that seem to the Council to give promise of therapeutic value. New and Nonofficial Remedies makes use of the Federal Trade Commission names for products originally introduced into this country by German manufacturers. These include arsphenamin, barbital and procain preparations replacing salvarsan, veronal and novocain respectively. The Council has omitted from the present edition all articles not now on the market many of them originating in enemy countries. Among the most valuable features of this book for the physician are the thorough discussions of various therapeutic substances, including composition, dosage, therapeutics, actions and uses, etc. The articles on digestive ferments, serums and vaccines and silver preparations have particularly been thoroughly revised, and it will be to the interest of every physician to acquaint himself with the present status of knowledge regarding the use of these preparations as brought out in this book. In a supplement to the book are given references to the reports of the Council on Pharmacy and Chemistry and the publications of The Journal regarding proprietary articles which have not been accepted. The material available in this book is nowhere else available and its authoritative character makes it a therapeutic guide which should be in the hands of every practitioner.